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RE/CD 2004 000109

5 FEBRUARY 2004 25.02.04

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Specification and Drawings, as originally filed, with Application for Patent Serial No:  
2,417,715, on January 27, 2003, by **DARRYL TREMBLAY AND RAYNALD  
TREMBLAY (CO-APPLICANT AND INVENTOR)**, for "Multifunction Tie Down  
Winch, Vehicle Including the Same and Method of Securing Cargo on a Vehicle".

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February 25, 2004

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(CIPO 68)  
04-09-02

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## MULTIFUNCTION TIE DOWN WINCH, VEHICLE INCLUDING THE SAME AND METHOD OF SECURING CARGO ON A VEHICLE

Field of the invention:

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The present invention relates to a multifunction tie down winch, to a vehicle including the same, and to a method of securing cargo on a vehicle. The multifunction tie down winch is particularly useful for various types of transportation vehicles, such as flatbed trucks, railcars, and the like.

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Background of the invention:

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It is known in the art that a trailer with platform is a road transportation vehicle which comprises a loading tray. There are various types of loads which may be transported on such a vehicle with platform and these generally consist of heavy objects, objects disposed on pallets, and/or other types of objects whose handling requires the use of hauling mechanisms, such as hoists, which typically have access to the load either by the side(s) of the vehicle or by the top thereof.

20

It is also known in the art that these types of transportation vehicles are generally equipped with transversal securement devices which are typically arranged along the longitudinal axis of the loading tray. The users of these vehicles must conform to the requirements of the Cargo Securement Standard, in regards to the use of securement devices of adequate capacity, the required number thereof being established according to the payload being transported and to the length of the load to be secured.

30

Typical securement devices, such as the tie down winch shown in Figure 1, are very well known in the art. Indeed, these types of winches are generally installed on a trailer, and more particularly are inserted onto rails present on each side of the trailer, and positioned at desired locations. They are used for tightening the fastening belts used to secure different loads carried by the trailer.

Known in the art are two main types of rails. On most trailers, winches are inserted onto the rails by means of corresponding grooves provided on the winches. On other trailers known as "Manac" type trailers, winches are inserted 5 on the rails by means of an optional plate which is typically welded on the top of the winch.

As better shown in Figure 2, a conventional tie down winch generally comprises a slit for receiving an end of a fastening strap, a reel for winding the 10 strap about the same, and a hole or opening for receiving a winding bar so as to be able to wind and tighten the strap about the reel. The installation of belts on conventional winches is generally carried out as follows. Firstly, the belt is inserted through the slit or opening(s) of the winch reel. This step is done only at the first installation of the belt on the winch. Secondly, the belt is then rolled-up 15 manually onto the winch reel, as better shown in Figure 3. The winding-up of the belt is generally done manually as shown. The belt is then passed over the load and fixed to the other side of the trailer by means of its hook, and tightened in place about the reel with a winding bar such as the one shown in Figure 1. Figure 20 4 shows a typical tie down winch about which a fastening strap has been tightened. As shown in this figure, the tie down winch is typically provided with a ratchet safety mechanism for maintaining a certain tightening of the strap and for preventing unwinding thereof.

A problem associated with this type of tie down winch and method of 25 tightening is that it is impossible to tighten rather securely the winch in position when it is not used. Indeed, this is explained by the fact that during the tightening, the winch moves in the same direction as the force applied which in turn provokes a premature wear of the trailer rails caused by the vibrations which result when the vehicle circulates.

30

As better shown in Figures 5 and 6, the operation of a conventional winch and corresponding belt is typically carried out by means of a winding bar which is

generally inserted into a corresponding hole on the right-hand side of the winch. The belt may be loosened by pushing the bar downwards. However, the latch must be raised to allow the reel to turn freely. As can be appreciated, this step is difficult because the use of both hands by an operator is required to manipulate

5 and the bar and the latch. The belt is then unwound in the desired length simply by pulling it. The belt is then pulled over a load to be fastened, to the opposite side of the trailer. As better shown in Figure 7, the belt is then fixed to the trailer support (or rail) on the opposite side of the trailer by means of its hook.

10 As better shown in Figure 8, the excess of the belt is then rolled-up and aligned manually on the winch reel, as aforementioned. The bar is then inserted into the hole or opening on the right-hand side of the winch. The belt is then tightened by pushing and pulling the bar downwards. It has been found in the art that this method of tightening requires a significant amount of force by the user on  
15 the bar and thus has been found to cause wounds, namely stresses and strains on different body parts of an operator of such typical tie down winches. Furthermore, since the tightening force transmitted to the fastening belt is directly proportional to the force applied by the operator with the bar, it has been found that the physical requirements and resulting fatigue of an operator generally has  
20 adverse consequences on the tightening tension applied to the fastening belt (not uniform, not constant, etc.).

Furthermore, it has also been found that since the belt is rolled-up on itself several times, as shown in Figure 8, there will be a loss of tension in the belt due  
25 to the yielding of the wound portion of the belt and as a result thereof, it is necessary that the transportation vehicle be stopped periodically and that the load be retightened several times during the transportation of the cargo, such as shown in Figures 9 and 10, which is very disadvantageous.

30 Also known in the art are other types of securement devices which are typically known as chain benders. Figure 11 illustrates a typical chain bender which comprises a bender and a tightening bar. These chain benders and

corresponding chains are often stored at the back of the tractor when it is not used, as better shown in Figure 12. Similarly to the fastening straps, a chain is generally pulled over the load and fixed to the trailer support (or rail) on the opposite side of the trailer by means of its hook, as better shown in Figures 7 and 5 13.

As better shown in Figures 14 and 15, the bender is then fixed to a link of the chain and to the support of the trailer by means of its hooks. The hook of the 10 chain bender must be moved on the link that will allow a tightening. The tightening bar is then inserted on the handle of the chain bender, as better shown in Figure 16, and tightening of the chain is carried out with the tightening bar, as better shown in Figures 17 and 18.

It has been found in the art that what often happens is that the link used 15 does not allow an adequate tightening of the chain. Indeed, in such a case, the chain should be differently spent on the load and the tightening must be redone. Figure 19 shows a typical example of improper tightening. As a result thereof, an additional device must be used to limit the dangers of such bad tightening. The 20 handle of the chain bender must be reassured by means of an elastic belt provided with hooks, as better shown in Figure 20, in order to impede the bender from opening itself and from having to retighten it (loss of time).

Also known in the art are the various disadvantages associated with the above-described types of conventional winches. Indeed, in regards to the 25 tightening of straps/chains, the conventional winch uses a principle of lever so as to enable to tighten the straps/chains. Indeed, a bar (typically three feet in length) must be inserted into a corresponding hole in the reel of the winch and pushed downwards to tighten the fastening straps by means of substantial physical requirement to the operator of the winch. The substantial disadvantages 30 of such tightening method is that it is very demanding physically and can cause serious harms and/or injuries to an operator. Furthermore, due to the poor design and components of such typical tie down winch and corresponding straps, the

tightening is often uneven on all the different winches of a trailer because the level of fatigue of the operator increases from the tightening of a first winch to the tightening of a subsequent winch. Indeed, it has been found that there are substantial tightening tension discrepancies between the first winch tightened by 5 the operator and the last winch tightened by the operator which in turn causes tightening unbalances along the cargo supported by the vehicle, which is very undesirable for stability reasons, as can be easily understood.

Another substantial disadvantage associated with conventional winches is 10 that the tightening force thereof is not constant and not uniform. As aforementioned, very often there is not enough tightening force present in the fastening straps, and/or there are differences in the tightening forces from one strap to another, and this increases the risk of slipping and shifting of the load during transportation, which is very undesirable.

15

Another disadvantage associated with conventional winches is that the tension applied to the belt is maintained by means of a latch fixed to the frame of the winch, which blocks the reel. In the advent of a reversal of the trailer, the pressure will be thus distributed by the latch onto the frame of the winch, and in 20 turn this will tend to deform the winch under the impact and release the load, which is very undesirable for obvious reasons known in the art.

Another problem associated with conventional winches is that the belt is 25 squeezed on itself around the reel of the winch during the tightening process which is undesirable because the belt presses on itself during the tightening, thereby resulting in a loss of tightening tension. Moreover, as a result thereof, the tightening is uneven on all the different winches of the trailer which in turn provokes a deformation and a premature wear of the trailer. Moreover, as a result of the aforementioned, there is a loss of tension in the belts due to the vibrations 30 during the transportation which in turn obliges the operator to frequently stop the vehicle and retighten the belt several times during a given trip. Moreover, there is

a premature wear of the belt during the tightening caused by the presence of sand and dusts between the windings up of the belt.

Another problem associated with conventional winches is that the belt 5 must be manually rolled-up on all its length about the reel of the winch before being tightening in place with the winding bar. This is undesirable because it is a long procedure and very time-consuming; does not allow to fix solidly the winch to the rails of the trailer because the winch moves in the same direction as the tightening force; and causes wear of the trailer rails to which winches are fixed 10 due to the vibrations of the winches when the vehicle circulates. Indeed, in certain cases, rails must be replaced on a yearly basis, which is very costly.

Another problem associated with conventional winches is that the operator must raise the latch to unblock the reel at the same time as he/she is attempting 15 to loosen the belt by means of the winding bar. This is very undesirable because it is difficult to operate the winch since the operator must use both hands to operate both the latch and the winding bar at the same time.

Another problem associated with conventional winches and with the chain-benders used therewith is that once again, the principle of lever is required to 20 tighten the chains, which in turn results in the same disadvantages associated with conventional winches and their straps. Indeed, this is very undesirable in that the method is very demanding physically and can cause serious harms and/or injuries to the operator of the winch. Moreover, an operator is often required to go 25 over the load in order to operate the chain benders, which may in turn result in falls from the load and serious injuries to the operator. Furthermore, the load is often unsufficiently or excessively tightened because the step of tightening is based on the length of a given chain link, which in turn causes an improper tightening and damages to the equipment.

Hence, in light of the aforementioned, there is a need for an improved winch which, by virtue of its design and components, would be able to overcome some of the aforementioned problems.

5 Summary of the invention:

The object of the present invention is to provide a winch which satisfies some of the above-mentioned needs and which is thus an improvement over the winches known in the prior art.

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In accordance with the present invention, the above object is achieved, as will be easily understood, with a winch such as the one briefly described herein and such as the one exemplified in the accompanying drawings.

15 According to another aspect of the invention, there is also provided the transportation vehicle provided with the above-mentioned winch.

According to yet another aspect of the invention, there is also provided the method of operating the above-mentioned winch, as well as the method of

20 securing cargo on a vehicle.

The objects, advantages and other features of the present invention will become more apparent upon reading of the following non-restrictive description of preferred embodiments thereof, given for the purpose of exemplification only

25 with reference to the accompanying drawings.

Brief description of the drawings:

Figure 1 is a perspective view of a winch and corresponding winding bar  
30 according to the prior art.

Figure 2 is an enlarged perspective view of the winch shown in Figure 1.

Figure 3 is a perspective view of a fastening strap being wound manually by an operator about the reel of a winch according to the prior art, said winch being shown mounted on a side of a trailer.

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Figure 4 is another perspective view of what is shown in Figure 3, the winch being shown now with the strap tightened about the reel when the winch is not being used for securing cargo.

10 Figure 5 is another perspective view of what is shown in Figure 4, said view illustrating schematically the loosening of the belt on the conventional winch.

15 Figure 6 is another perspective view of what is shown in Figure 5, the winch being shown now with its latch being manipulated by an operator and being further shown provided with a winding bar.

Figure 7 is a perspective view of a hook of a fastening strap or chain bender secured against a side rail of a trailer according to the prior art.

20 Figure 8 is a perspective view of a fastening strap being wound manually by an operator about the reel of a winch according to the prior art, said winch being shown mounted onto a side of a trailer.

25 Figure 9 is a perspective view of an operator tightening a fastening strap with a winch and corresponding winding bar according to the prior art.

Figure 10 is another perspective view of the operator shown in Figure 9 further tightening the strap with the winch and corresponding winding bar.

30 Figure 11 is a perspective view of a chain bender and tightening bar according to the prior art.

Figure 12 is a perspective view of conventional benders stored at the back of a tractor.

Figure 13 is a perspective view of a load secured onto a trailer by means 5 of chains according to the prior art.

Figure 14 is a perspective view of an operator employing a conventional bender with corresponding chains to secure a load onto a trailer according to the prior art.

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Figure 15 is a perspective view of an adjustment of the hook by the operator on the chain shown in Figure 14.

Figure 16 is a perspective view of a tightening bar being inserted by an 15 operator onto a chain bender according to the prior art.

Figure 17 is a perspective view of an operator tightening a chain with corresponding chain benders and tightening bar according to the prior art.

20 Figure 18 is another perspective view of the operator shown in Figure 17 further tightening the chain.

Figure 19 is a perspective view of a chain having been improperly tightened according to the prior art.

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Figure 20 is a perspective view of handles of chain benders being reassured by means of an elastic belt provided with hooks.

Figure 21 is a schematic view of a flatbed trailer provided with multifunction 30 tie down winches according to the present invention.

Figure 22 is a front plan view of the winch according to a first preferred embodiment of the invention.

Figure 23 is a right side elevational view of what is shown in Figure 22.

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Figure 24 is a left side elevational view of what is shown in Figure 22, the gear of the winch being shown uncoupled.

10 Figure 25 is a left side elevational view of what is shown in Figure 22, the gear of the winch being shown coupled.

Figure 26 is an exploded view of the components of the winch shown in Figure 22, certain components thereof being shown in enlarged views.

15 Figure 27 is a perspective view of the winch according to another preferred embodiment of the invention; said winch being shown with a corresponding crank, said crank being shown provided with a corresponding socket.

20 Figure 28 is a perspective view of the winch shown in Figure 27 mounted on a Manac type trailer.

Figure 29 is another perspective view of the winch shown in Figure 28, the winch being shown now cooperating with a fastening strap.

25 Figure 30 is another perspective view of what is shown in Figure 29, the fastening strap being shown winding up with the winch by means of a crank being manipulated by an operator.

30 Figure 31 is another perspective view of what is shown in Figure 30, the winch being shown now after it has been tightened in position when it is not being used for securing a cargo.

Figure 32 is another perspective view of what is shown in Figure 31, the winch being shown now during the loosening of the strap by a crank manipulated by an operator.

5 Figure 33 is another perspective view of what is shown in Figure 32, the winch being shown now during operation of the latch on said winch.

Figure 34 is another perspective view of what is shown in Figure 33, the winch being shown now during unwinding of the belt by an operator.

10 Figure 35 is another perspective view of what is shown in Figure 34, the fastening strap being shown held by an operator prior to passing it over the load to be secured.

15 Figure 36 is another perspective view of what is shown in Figure 35, the winch being shown now during winding-up of the excess belt by an operator with the crank.

20 Figure 37 is another perspective view of what is shown in Figure 36, the winch being shown now during tightening of the belt with the tightening reel of the winch by means of the crank manipulated by an operator.

Figure 38 is a partial perspective view of a strap fastened about a cargo on a trailer with the winch shown in Figure 37.

25 Figure 39 is a perspective view of the winch according to another embodiment of the present invention, the winch being shown mounted on a side of a trailer, cooperating with a chain and being used as a chain bender.

30 Figure 40 is a perspective view of a hook of the chain shown in Figure 39 being fixed to an opposite side of a trailer.

Figure 41 is an enlarged view of a portion of what is shown in Figure 39, the chain being bent by the bending plate of the winch.

Figure 42 is another perspective view of what is shown in Figure 39.

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Figure 43 is a perspective view of a conventional winch according to the prior art next to a multifunction winch according to the present invention, said winches being shown with corresponding winding bar and crank respectively.

10 Figure 44 is a left side elevational view of the winch according to yet another preferred embodiment of the invention.

Figure 45 is an enlarged exploded view of a portion of what is shown in Figure 44.

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Figure 46 is a perspective exploded view of what is shown in Figure 45.

Detailed description of proposed embodiments of the invention:

20 In the following description, the same numerical references refer to similar elements. The embodiments shown in Figures 21-43 are preferred.

Moreover, although the present invention was primarily designed for use with a flatbed truck, it may be used with other types of transportation vehicles and objects, such as railcars for example and the like, and in other fields, as apparent to a person skilled in the art. For this reason, expressions such as "flatbed", "truck", "railcar", etc., used herein should not be taken as to limit the scope of the present invention and includes all other kinds of objects or fields with which the present invention could be used and may be useful.

30

Moreover, in the context of the present invention, the expressions "winch", "device", and any other equivalent expression and/or compound words thereof

known in the art will be used interchangeably. Furthermore, the same applies for any other mutually equivalent expressions, such as "belt", "chain", and "strap", or "fasten" and "secure", for example, as also apparent to a person skilled in the art.

5        In addition, although the preferred embodiment of the present invention as illustrated in the accompanying drawings comprises various components such as gears, a winding reel, a chain bending plate, washers, pins, a pivot, a worm, a thrust, rods, etc., and although the preferred embodiment of the winch 101 as shown consists of certain geometrical configurations as explained and illustrated  
10      herein, not all of these components and geometries are essential to the invention and thus should not be taken in their restrictive sense, i.e. should not be taken as to limit the scope of the present invention. It is to be understood, as also apparent to a person skilled in the art, that other suitable components and cooperations  
15      thereinbetween, as well as other suitable geometrical configurations may be used for the winch 101 and corresponding parts according to the present invention, as will be briefly explained hereinafter and as can be easily inferred herefrom, without departing from the scope of the invention.

20      Moreover, it is important to notice that the multifunction winch 101 illustrated in the accompanying drawings is a prototype only. Indeed, the illustrated winch 101 does not represent a final product. As a result thereof, certain components of the present winch 101 may be missing and/or have not been optimized. Thus, the present winch 101 illustrated in the accompanying drawings is to be used for purposes of understanding only and should not be taken in any limiting way. Figures 22-26 provide a more complete description of  
25      the multifunction winch 101 according to the present invention than the one illustrated in the other figures. Please note also that the winch 101 according to the present invention is shown partially in some of Figures 1-20 in which prior art winches are mostly demonstrated.

Furthermore, in the context of the present description and as shown in the accompanying drawings, the present winch 101 has been illustrated mounted on

a trailer of type "Manac" for demonstration purposes only but may also be used on other types of rails, such as the ones onto which winches are inserted by means of their corresponding grooves.

5 Broadly described, the present invention relates to a multifunction tie down winch 1 to be used as a securement device used to fix cargo during transportation on flatbeds, railcars, and the like, as shown in Figure 21. The present winch serves for tightening belts 103 and/or chains 105 used to hold down different types of loads 107 during the transportation thereof on such  
10 vehicles 109. The present winch 101 is preferably of simple design and inexpensive to manufacture. As will be shown hereinbelow, the present winch 101 possesses several advantages when compared to conventional winches known in the art.

15 Referring now more particularly to Figures 22-26.

Preferably, the winch 101 comprises a frame 111 which is preferably a piece in the shape of an inverted "U" to which all the other components are operatively assembled or fixed. Its sides are preferably provided with holes 20 through which the tightening reel 113 and the winding up reel 115 are inserted. On the frame 111 are preferably fixed the pivot of the pivoting support 8, the pivot of the latch 20 and the thrust 12. Preferably, there is two grooves on each side of the frame 111 which allow to insert the winch 101 on the rails of a trailer 109 and to make it slide to a desired position therealong.

25

Preferably, the winch 101 also comprises a gear which is preferably a piece welded on the tightening reel 113. Preferably provided with grooves, it is preferably driven by the worm 11 and allows the rotation of the tightening reel 113 in the desired direction.

30

Preferably, the tightening reel 113 is a mechanical pipe driven by the gear 2 and around which the belt is rolled up during the tightening. Preferably, two

openings on each side of the tightening reel 113 allow to insert the belt 103 and to block it during the tightening. Preferably also, the tightening reel 113 also allows to drive the chain bending plate 5.

5 Preferably, the tightening head is an hexagonal rod welded on a given side of the tightening reel 113, preferably the right-hand side. It allows to drive the tightening reel 113 and the chain bending plate 5 directly on their axis. The tightening head is preferably provided with a hole to receive a corresponding pin 7.

10 Preferably, the chain bending plate is an "L-shaped" piece provided with an hexagonal hole through which it is fitted onto the tightening head 4. The chain bending plate is also preferably provided with a slot allowing to insert the link of a chain 105 to bend it and apply tension thereon.

15 Preferably, a washer is inserted around the tightening head 4, and serves as support for the pin 7 to maintain in place the tightening head 4 and the other components which are interdependent to it.

20 Preferably, the winch 101 also comprises a pin which is preferably a cylindrical piece inserted into a hole on the tightening head 4 and takes support on the washer 6. It preferably holds the tightening head 4 and the components which are interdependent to it.

25 Preferably, the winch 101 also comprises a pivot which is preferably a cylindrical rod welded on one the left side of the frame 111 and is provided with a hole in its other extremity to receive a pin 14. The pivot preferably serves for maintaining and for making revolve on its axis the pivoting support 9.

30 Preferably, the winch 101 also comprises a pivoting support which is preferably a piece of particular shape pivoting on a pivot 8 allowing it to couple

and to uncouple on the gear 2. It is preferably used as a support for the worm 11 and to the tightening head 10.

Preferably, the tightening head is a piece provided on in a certain length of 5 an hexagonal part and inserted into the worm 11 through a circular opening practiced in the pivoting support 9. It is preferably interdependent of the worm 11 and allows the worm 11 to turn along opposite first and second directions.

Preferably, the worm is maintained on the pivoting support 9 by means of 10 the tightening head 10. Activated in both directions by the tightening head 10, it allows to drive the gear 2 to transmit the tightening force.

Preferably, the winch 101 also comprises a thrust which is preferably a rectangular piece welded on the frame 111 serving as support for the pivoting 15 support 9 to limit its movement in its coupled position.

Preferably, the winch 101 also comprises a washer which is preferably inserted around the pivot 8, serving as support for the pin 14 in order to maintain on its transversal axis the pivoting support 9.

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Preferably, the winch 101 also comprises a pin which is preferably inserted into a hole on the pivot 8 and takes support on the washer 13. It preferably holds the pivoting support 9 and the components which are interdependent to it.

25

Preferably, the winch 101 also comprises a tightening head which is preferably an hexagonal piece welded on the winding up reel 115. It preferably allows to pass on the necessary force to make turn the winding up reel 115.

30

Preferably, the winch 101 also comprises an indented wheel which is preferably a circular piece provided with teeth and welded on the tightening head 15. Preferably also, its oblique teeth take support against the latch 21 and allows its rotation in the clockwise direction only when the latch is engaged.

Preferably, the winding up reel 115 is a mechanical pipe driven by the tightening head 15 all around of which the excess of the belt is rolled up. Preferably, two openings on each side of the winding up reel 115 allow to insert 5 the belt and to block it during the tightening.

Preferably, the winch 101 also comprises a washer which is preferably inserted around the winding up reel 115, serving as support for the pin 19 to maintain on its transversal axis the winding up reel 115.

10 Preferably also, the winch 101 also comprises a pin which is preferably inserted into a hole on the winding up reel 115 and takes support on the washer 18. Preferably also, it holds the winding up reel 115 and the components which are interdependent to it.

15 Preferably, the winch 101 also comprises a first rod which is preferably inserted into the latch 21 and welded on the frame 1. It serves for supporting and for making revolve freely the latch 21 on its transversal axis.

20 Preferably, the winch 101 also comprises a latch which is preferably a piece revolving on the pivot 20. Activated manually, the latch can be disengaged so allowing the indented wheel 16 to turn in both directions. When engaged on the indented wheel 16, the latch blocks the wheel and allows its rotation in the direction of tightening only to avoid that the belt be unrolled.

25 Preferably, the winch 101 is operated with a crank 117 which is a tool preferably provided with an hexagonal socket 119 coming to couple on the tightening heads 4, 10 and 15 and allowing to pass on the necessary force to make them turn in a direction or in the other one.

30 Contrary to conventional winches, the multifunction winch 101 according to the present invention preferably uses a crank 117, as better shown in Figure 27,

the crank 117 being preferably provided with a standard hexagonal socket 119 to make the tightening of the corresponding fastening strap 103.

The winch 101 according to the present invention is preferably inserted  
5 onto a corresponding rail 121 on a proper side of the trailer 109 and positioned at a suitable location for securing the cargo on the trailer. Preferably, a plurality of such winches 101 is used, as apparent to a person skilled in the art. The present winch 101 may be inserted onto the rail 121 by means of grooves 123 or may be inserted on the rail by means of an optional plate 125 welded on the top of the  
10 winch, the latter case being used typically for a "Manac" type trailer, as better shown in Figure 28.

According to the present invention, the installation of a belt 103 on a winch 101 is preferably carried out as follows. Firstly, the belt 103 is inserted through a  
15 slit or opening of the tightening reel 113 and then through the opening of the winding reel 115, as better shown in Figure 29. This step is generally done only at the first installation of the belt on the winch 101. Preferably, the belt 103 is then rolled-up by means of the crank 117 on the winding up reel 115 of the winch 101, as better shown in Figure 30. This step is very fast when compared to what is  
20 possible with conventional winches.

The belt 103 is then passed over the cargo 107 and fixed to the opposite side of the trailer by means of its hook 127, and tightened in place via the winch 101 with the crank 117. As can be easily understood from the aforementioned,  
25 since the portion of the strap 103 which is not used to secure the cargo is wound about the winding reel 115, only a few turns about the tightening reel 113, i.e. two to four turns around the tightening reel 113 are required according to the present invention for properly securing the strap and applying the necessary tension thereon. This method of tightening allows to fix solidly the winch 101 to the side of  
30 the trailer 109 and prevents it from vibrating when the vehicle circulates.

The operation of the winch 101 according to the present invention is also advantageous in that the belt 103 may be loosened by means of the crank 117 simply by turning some turns along a given direction, preferably counterclockwise, as better shown in Figure 32. The pivoting support uncouples 5 automatically the gear. The latch is then raised to allow the winding up reel 115 to turn freely, as better shown in Figure 33. The belt 103 is then unwound in the desired length simply by pulling it, as better shown in Figure 34. The belt 103 is then pulled over the load to be fastened, to the opposite side of the trailer 109, as can be easily understood when referring to Figure 35 and Figure 1. The belt 103 10 is then fixed to the trailer support on the opposite side of the trailer 109 by means of its hook 127, as better shown in Figure 40.

The excess of the belt 103 is then rolled-up by means of the crank 117 on the winding up reel 115 of the winch, as better shown in Figure 36. This step is 15 very fast when compared to what is possible with a conventional winch and further allows to align the belt automatically.

Preferably, the belt 103 is then tightened by means of the crank 117 simply by turning some turns along a given direction, preferably in the clockwise 20 direction. This method of tightening does not require a lot of force because the ratio of the worm and the gear according to the present invention is devised to be important and to multiply the force applied by the operator onto the crank 117. This method of tightening also allows to obtain a more uniform tightening on all 25 the winches 101 because the fatigue and physical capabilities (i.e. strength) of the operator are no longer significant factors which influence the tightening of the straps 103.

Preferably, two to four turns of the belt about the tightening reel 113 are sufficient. The winch is fast and allows the belt to keep its tension because it 30 winds on itself only a few turns, as better shown in Figure 37. Indeed, the portion of the strap 103 which is not used for fastening the load is wound about a separate winding reel 115.

Alternatively, it is possible to use a ratchet key with a conventional socket to make the tightening. The key is then inserted on the tightening head of the tightening reel 113 and activated in the clockwise direction for example to tighten

5 the belt. Preferably, the pivoting support uncouples automatically during the tightening. Preferably also, to maintain the tension once the tightening is done, one simply has to push the pivoting support against the gear and remove the key, the pivoting support coupling automatically on the gear.

10 Figure 38 shows an outline of the load 107 once it has been fastened with a belt 103 and corresponding winch 101 according to the present invention. It is worth mentioning that this type of load 107, namely stone and the like, is usually secured with chains 105 and corresponding chain benders, but has been illustrated herein secured with straps 103 for demonstration purposes only.

15 According to the present invention, the use of chains 105 and/or straps 103 may be used depending on the type of load 107 having to be secured, as apparent to a person skilled in the art..

20 Contrary to conventional winches which require the use of chain benders when using chains as fastening straps to secure a cargo on a trailer, the multifunction winch according to the present invention is preferably provided with a chain bending plate 129 allowing it to be used as a chain bender, so as to eliminate the need for a conventional chain bender. The present winch with corresponding chain bending plate 129 uses a similar method of tightening as

25 when it is used to tighten a belt.

Once again, it is important to note that the winch 101 illustrated in the accompanying drawings, namely in Figures 21-43, is a prototype used for comprehension purposes only, and that the winch 101 illustrated in Figures 22-30 26, show the integration of the chain bending plate 129 on the multifunction winch 101. Figure 39 shows an illustration of a multifunction winch 101 according to the present invention which is being used as a chain bender.

As better shown in Figure 40, the chain 105 is pulled over the load 107 and fixed to the trailer support on the opposite side of the trailer 109 by means of its hook 127.

5

Preferably, the chain bending plate 129 is positioned at the horizontal, and a link of the chain 105 is then inserted into the slot 131 of the chain bending plate 129, as better shown in Figure 41. It is worth mentioning that it is not necessary to remove the belt 103 of the winch 101 to use the chain bending plate 129, which is also very advantageous.

10

As better shown in Figure 42, the crank 117 is then inserted on the tightening head of the pivoting support and turned along a given direction, in the clockwise direction for example, to tighten the chain 105 (i.e. apply tension thereon to secure the load).

15

Preferably, approximately one quarter of a turn is necessary for the chain bending plate 129 to obtain the required tension on the chain 105. The method of tightening of the multifunction winch 101 according to the present invention is faster and requires much less force than what is possible with conventional winches, and thus eliminates the risk of accidents and injuries during its use to the operators thereof.

25

Figure 42 shows an illustration of the tightening of a chain 105 with the present winch according to the present invention.

30

As may now be appreciated, the present invention is a substantial improvement over the winches known in the prior art in that, by virtue of its design and components, the winch 101 according to the present invention overcomes several of the prior art problems.

More particularly, in regards to tightening, the present winch 101 preferably uses a worm which drives a gear. The worm is preferably activated by means of a crank 117 and the necessary effort is reduced by many thanks to an important ratio of couple between the worm and the gear. The advantages resulting therefrom are that the use of this type of system eliminates the risk of injuries to the operator of the winch 101; the tightening does not require a big physical effort by the operator; and the tightening is more uniform on all the winches 101 throughout the trailer 109. Alternatively, as aforementioned, it is also possible to use a ratchet key with a standard socket 119 to make the tightening. Preferably, 5 the key is inserted on the tightening head of the tightening reel 113 and activated in the clockwise direction to tighten the load. Preferably also, the pivoting support uncouples automatically during the tightening. Preferably, to maintain the tension 10 once the load is tightened, one must simply pushes the pivoting support against the gear and removes the key, the pivoting support coupling automatically on the 15 gear.

Concerning the tightening force, the multifunction winch 101 according to the present invention is advantageous in that, as can be easily understood from the aforementioned and the accompanying drawings, the tightening force which is 20 achievable with the present winch 101 is more constant and uniform than what is possible with the winches of the prior art. Indeed, a bigger force of tightening may be achieved and there is less risk that the resulting secured load moves during the transportation.

Concerning the maintaining of the tightening tension in the fastening straps 25 103, the present winch 101 according to the present invention is also advantageous in that the tension of tightening is maintained by the pressure exercised between the gear and the worm. Advantages resulting therefrom are that the pivoting support stands by the tightening reel 113 and becomes 30 independent from the frame 111 of the winch 101. The winch 101 will thus less tend to deform during a reversal of the trailer 109 for example.

Concerning the roll-up of the belt 103 during the tightening, the multifunction winch 101 according to the present invention is also advantageous when compared to those of the prior art in that only about two to four turns of belt are preferably rolled-up on the tightening reel 113 to provide the belt with a 5 suitable tension. The excess of the belt 103 is previously rolled-up on the winding up reel 115. Advantages resulting therefrom are that there is a greater tightening force because a reduced portion belt 103 presses onto itself; the tightening is more uniform on all of the winches 101; it allows the operator to avoid stopping the vehicle 109 and retightening the belts 103 during the transportation; and there 10 is a decrease of the wear of the belts 103.

Concerning the roll-up of the belt 103 when the winch 101 is not used, it can be also be appreciated that the multifunction winch 101 according to the present invention is also advantageous when compared to those of the prior art. 15 Indeed, only about two to four turns of the belt 103 is rolled-up on the tightening reel 113 of the winch 101 in order to fix it securely. Moreover, the excess of the belt 103 not used for securing is rolled-up on the winding up reel 115 by means of a crank 117. Advantages resulting therefrom are the following: a fast procedure; a principle of tightening which allows to fix securely the winch 101 to the rail 121 of 20 the trailer 109; and the elimination of wear of rails due to vibrations which occur during circulation of the trailer 109.

Concerning the unrolling of a belt 103, the present winch according to the present invention is also advantageous in that once the worm is uncoupled by 25 means of the crank 117, the operator has only to raise the latch and unroll the belt 103. Indeed, the winch 101 according to the present invention allows the use of a single hand to unroll the belt 103.

The winch 101 according to the present invention is also advantageous in 30 that it may be provided with an optional dynamometric socket 119. Indeed, according to the present invention, it is possible to use a crank 117 or a key provided preferably with an hexagonal dynamometric socket 119 such that it is

possible to obtain exactly the same tension of tightening on all the winches 101, something that is not possible with conventional winches as aforementioned.

The present invention is also advantageous over the prior art in that the multifunction winch 101 according to the present invention is provided with a chain bending plate 129 which acts as an integrated chain bender. The advantages resulting therefrom are that the use of this system eliminates the need for a conventional chain bender; eliminates the risks of injuries; it does not require a big physical effort by the operator to tighten the load 107; the operator carries out the tightening without having to go over the load 107; and the tension of tightening is substantially controlled and uniform on all the winches 101.

The multifunction tie down winch 101 according to the present invention may be used on flatbed trailers 109, such as the one shown in Figure 21, or may be used on other types of transportation vehicles, such as railway vehicles, maritime transportation, and the like.

The multifunction tie down winch 101 according to the present invention is preferably devised so as to conform with the requirements of the Cargo Securement Standards, in regards to the use of securement devices of suitable capacity, the required number thereof being established according to the load 107 being transported and to the length of the load 107 to be fastened.

The multifunction tie down winch 101 according to the present invention is preferably shaped and sized, as well as made of suitable materials, so as to meet all the requirements of the North American Cargo Securement Standard.

Preferably, the components of the multifunction tie down winch 101 according to the present invention are made of suitable metallic materials, such as steel for example, or any other suitable composite material, as apparent to a person skilled in the art.

Several modifications can be made to the winch without departing from the scope of the present invention. Indeed, as apparent to a person skilled in the art, it is also possible to use a ratchet key provided with a standard socket to make the tightening. The key can then be inserted on the tightening head of the 5 tightening reel 113 and activated in the clockwise direction for example to tighten the load. The pivoting support could uncouple automatically during the tightening. To maintain the tension once the chain 105 is tighten, one would simply have to push the pivoting support against the gear and remove the key, the pivoting support preferably coupling automatically on the gear.

10

As also apparent to a person skilled in the art, it is possible to use a crank 117 or a ratchet key provided with a suitable socket 119, such as an hexagonal dynamometric socket 119 for example. In this way, it is possible to obtain substantially the same and required tightening tension on all the winches 101 of 15 the trailer 109.

As also apparent to a person skilled in the art, it is possible to make the winch without the winding up reel 115. This way, the winch 101 will be more similar to a conventional winch but will still be provided with all the advantages of 20 using the worm gear instead of a winding bar.

As also apparent to a person skilled in the art, it is possible to cover the worm gear assembly of the winch 101 with a specially designed enclosure to protect it from water, sand, dust and the like.

25

As also apparent to a person skilled in the art, it is possible to provide the winch 101 with a locking system for the winding up reel 115. Indeed, instead of using an indented wheel and a latch to lock the winding up reel 115 once the load 107 is tightened, it is possible to use two pivoting arms for example fixed at the 30 bottom of each internal side of the frame 111. These two arms will preferably serve as a support for the tightening reel 113, the worm gear assembly and the chain bending plate 129. During the tightening, the arms can rotate and move up

due to the force applied, and lock the winding up reel 115 at the end of their movement.

Several other modifications can be made to the winch and to the components thereof without departing from the scope of the present invention. For example, several modifications could be made to the components 8, 9, 10, 11, 12, 13, and 14 of the embodiment of the tightening system shown in Figure 26, so as to be able to replace these components and also reduce manufacturing costs while still preserving the same advantages of the embodiment illustrated in Figure 26. An example of such modification is better shown in Figures 44 and 45.

Indeed, according to this particular embodiment, the tightening system of the winch 101 according to the present invention comprises preferably the following preferred components: a protecting cover 150, a locking mechanism 151, a rivet 152, a stopper 153, a pipe 154, a worm 11, a spring 155, a seal 156, a stopper 157, a pin 158, and a lubricant point 159.

Preferably, the protection cover 150 is a cover fixed to the frame 111 and devised to protect from dust, water, and the like, the components that it covers, namely components 2, 153, 154, 11, 155, 156, 157, and 158 for example. Preferably also, the cover also enables to contain a lubrication material, such as grease for example, which serves to lubricate the set of pieces covered by the cover.

Preferably also, the locking mechanism 151 is a piece provided with a slot in its upper portion enabling it to slide vertically and to come lock the hexagonal head of the pin 158. It is preferably held in place by means of two fasteners, which are preferably two rivets 152.

Preferably, these two rivets 152 are fixed on the protecting cover 150 and enable to maintain and to allow sliding of the locking mechanism 151 vertically in order to lock and unlock pin 158.

Preferably also, the stopper 153 is a piece which is inserted and fixed at the end of the pipe 154 and serves as a support to the pin 158. It is preferably provided with a circular opening enabling pin 158 to turn freely about its 5 longitudinal axis.

Preferably also, the pipe 154 is a mechanical tube fixed to the frame 111 and in which the components 11, 155, 156, and 157 for example are inserted. It is 10 preferably provided with an opening on the upper portion thereof for enabling the worm 11 to reach and activate gear 2.

Preferably also, the worm 11 is a screw activated along both directions by pin 158, and enables to drive gear 2 in order to transmit the tightening force.

15 Preferably also, spring 155 is a spring resting against a side on the worm 11 and against the other side on the seal 156. It enables to maintain a pressure on the seal 156 to impede the lubrication material, such as grease for example, for exiting and also prevents dust, and the like, from entering in the protecting cover 150.

20 Preferably also, the seal 156 serves as a sealing joint between the protecting cover 150 and the exterior.

25 Preferably also, the stopper is a circular ring fixed to the pipe 154 and serves to maintain in place components 11, 155, 156, and 158 for example.

Preferably also, the pin is a rod provided with an hexagonal tightening head at one end and fixed to the worm 11. Preferably also, it is secured to the worm 11 and enables to rotate the worm 11 in one direction or the other.

30 Preferably also, the lubricant point is a lubrication point fixed on the protecting cover 150 for the lubrication, also known as "greasing", of the

mechanism with a lubrication device, such as a standard "grease gun" for example.

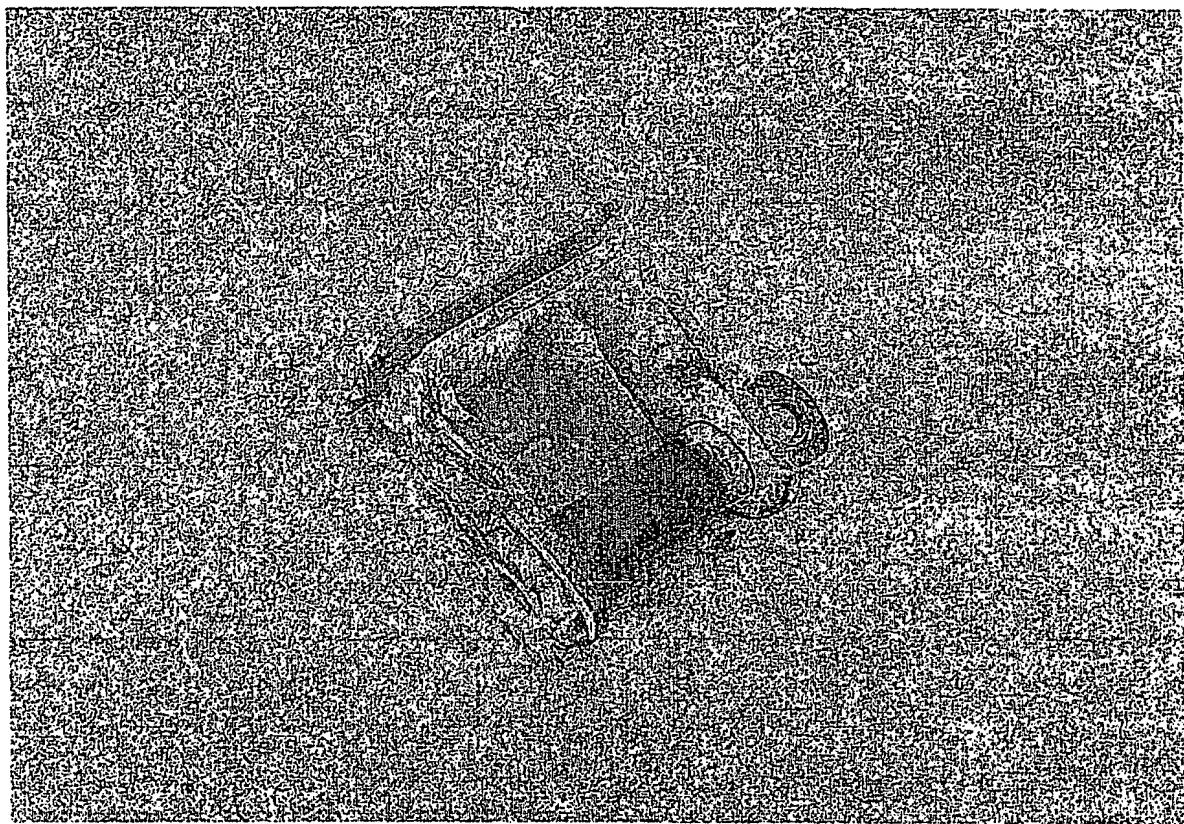
As may now be appreciated, the present invention is a substantial improvement over the winches of the prior art in that, by virtue of its design and components, as briefly explained herein, the winch 101 according to the present invention a) eliminates the risk of accidents and serious injuries associated to the use of conventional winches; b) facilitates the return to the work of people having suffered from recent injuries (e.g. back or other body parts) since the physical requirements for operating the present winch 101 are fairly negligible; c) allows people with limited physical strength to reach more easily the market of the transportation by flatbed trailers, thus opening the door to woman drivers for example; d) allows to obtain a more powerful tightening of the loads 107 without requiring much physical effort from the operator; e) allows to obtain a more uniform tightening on all the winches 101 of the trailer 109; f) allows to avoid having to frequently stop the vehicle and retighten the load 107 several times during the transportation of the cargo; g) decreases the time required for the tightening of a load 107; h) eliminates the use of conventional chain benders; i) increases the road safety by decreasing the risk of slipping and shifting of a load 107 during transportation; j) reduces the wear of the belts 103; k) reduces the operational costs in terms of time and material being used; l) will possibly allow the owners to benefit from reduction on insurance allowances or premiums paid to organisms involved in the management of transportation due to the decrease in the probability of injuries related to the use of the winches 101; and m) is preferably devised to meet with the requirements of the new North American Cargo Securement Standard.

Of course, numerous modifications could be made to the above-described embodiments without departing from the scope of the invention as apparent to a person skilled in the art.

**FIGURE 1**

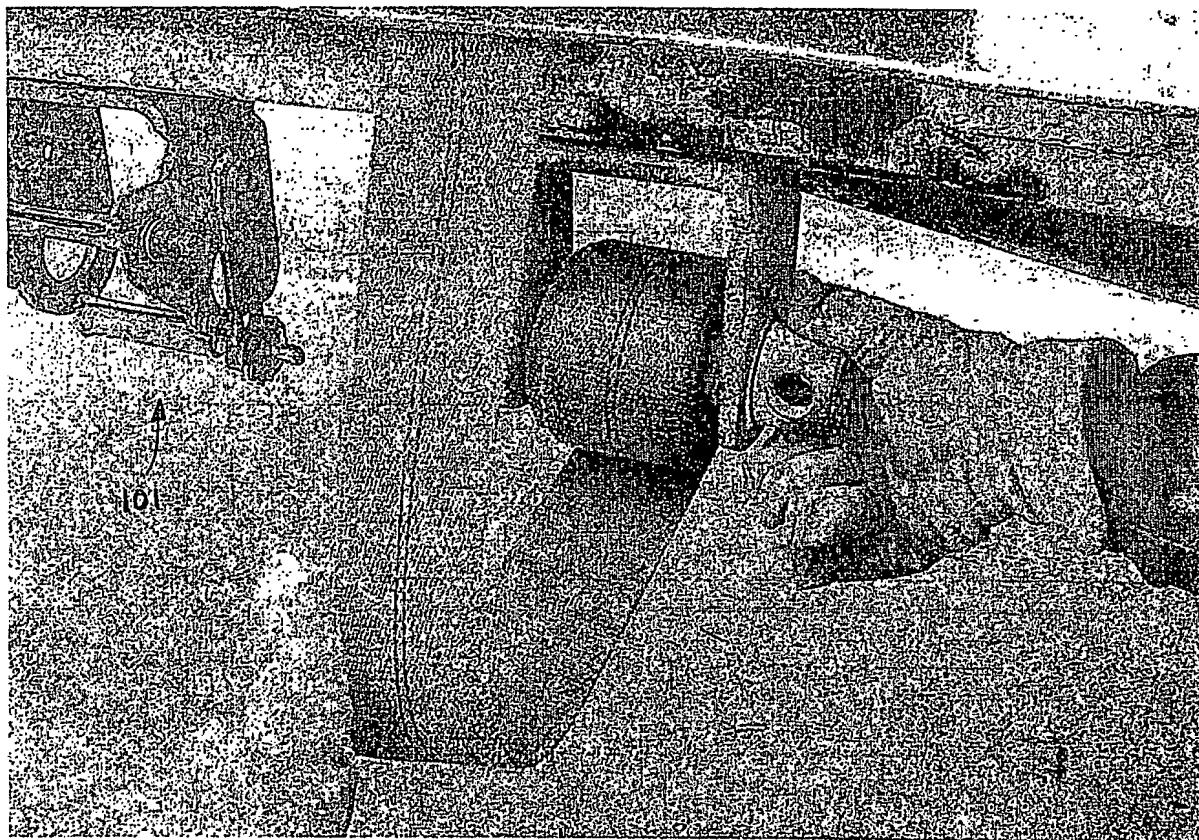


**FIGURE 2**



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**FIGURE 3**



**FIGURE 4**

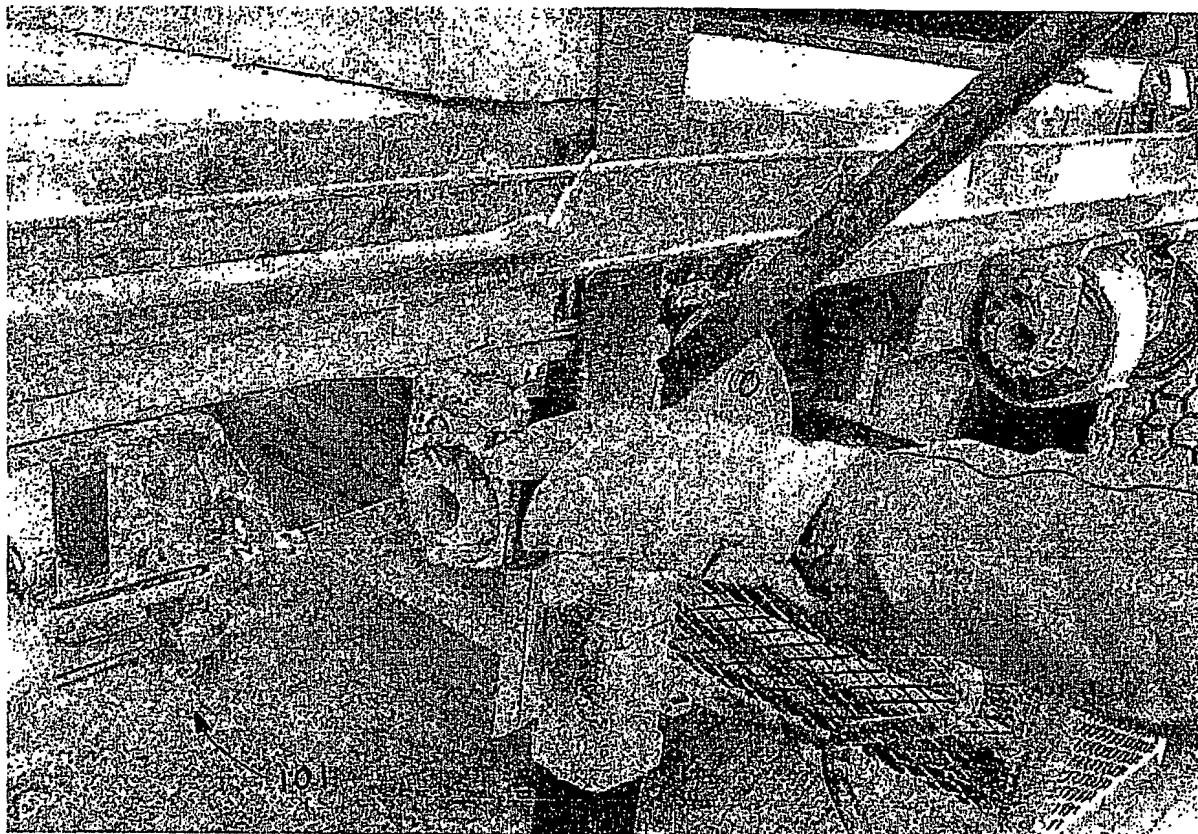


**FIGURE 5**

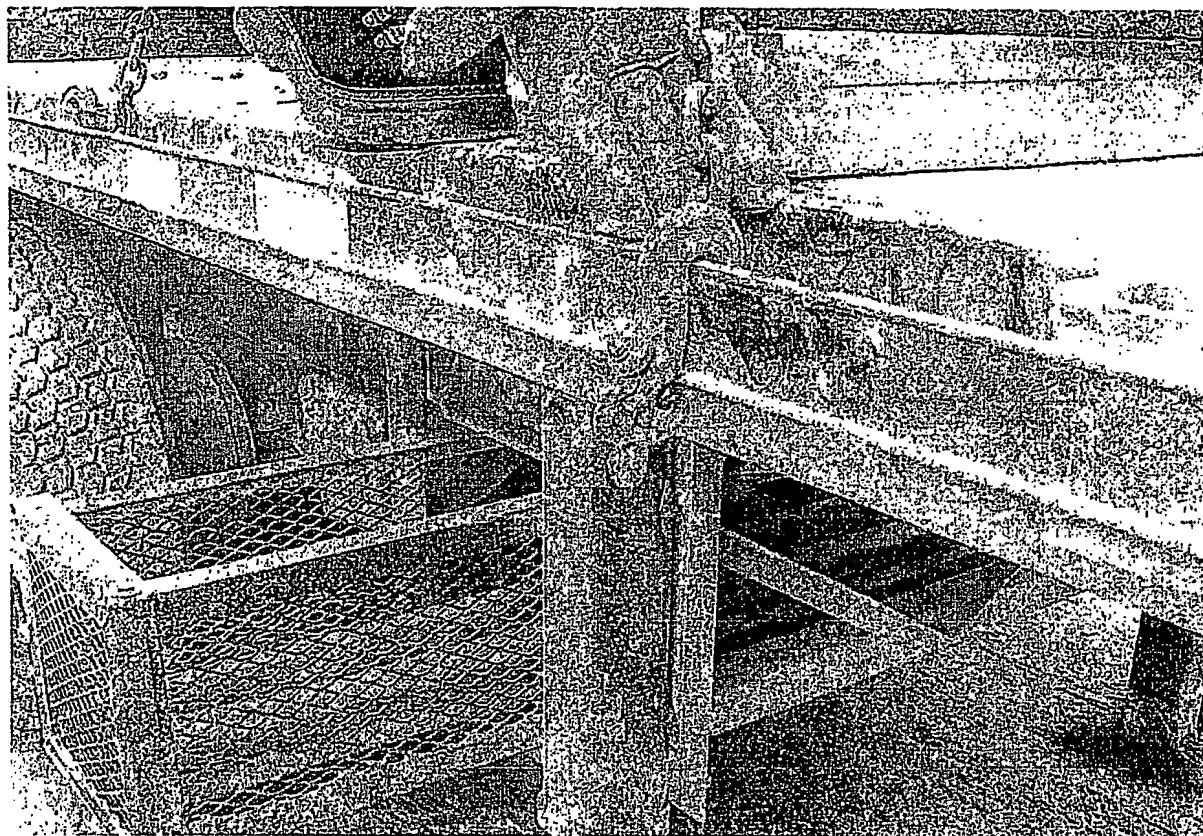


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**FIGURE 6**

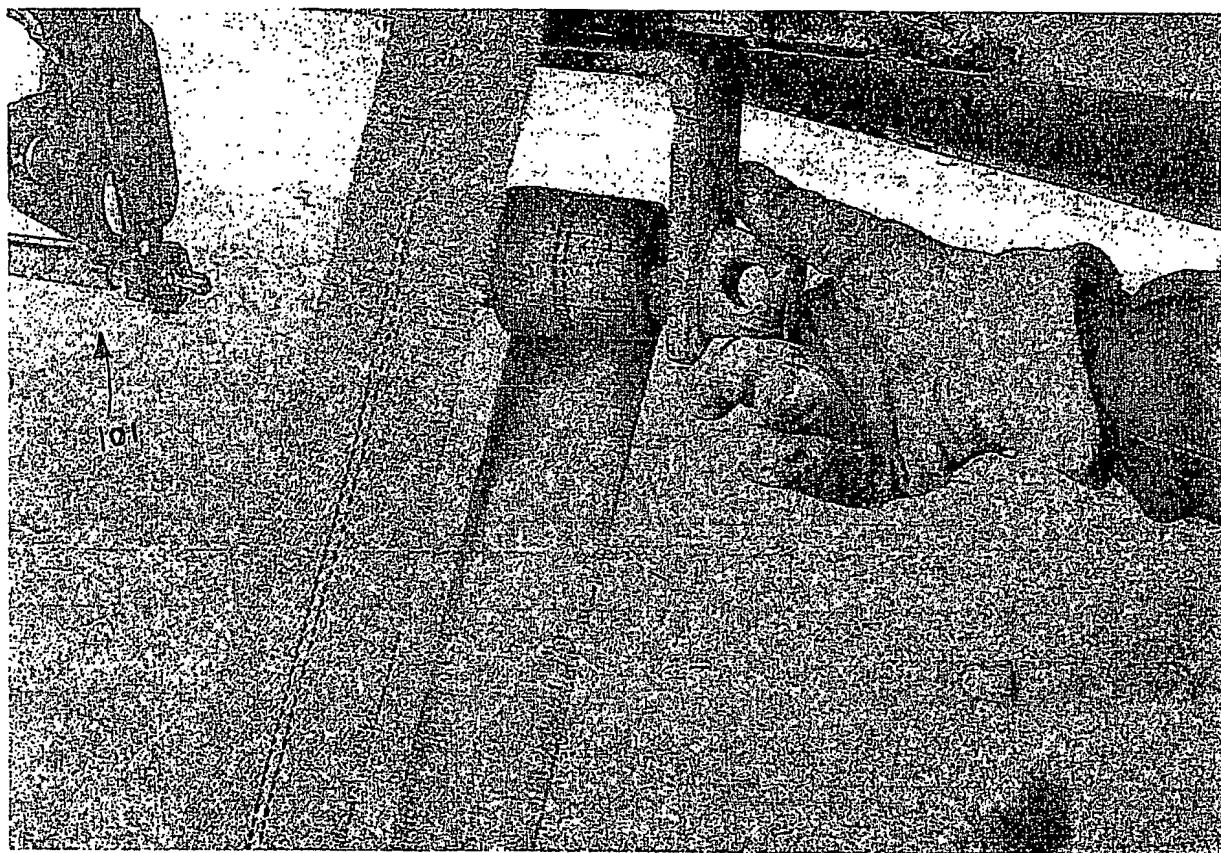


**FIGURE 7**

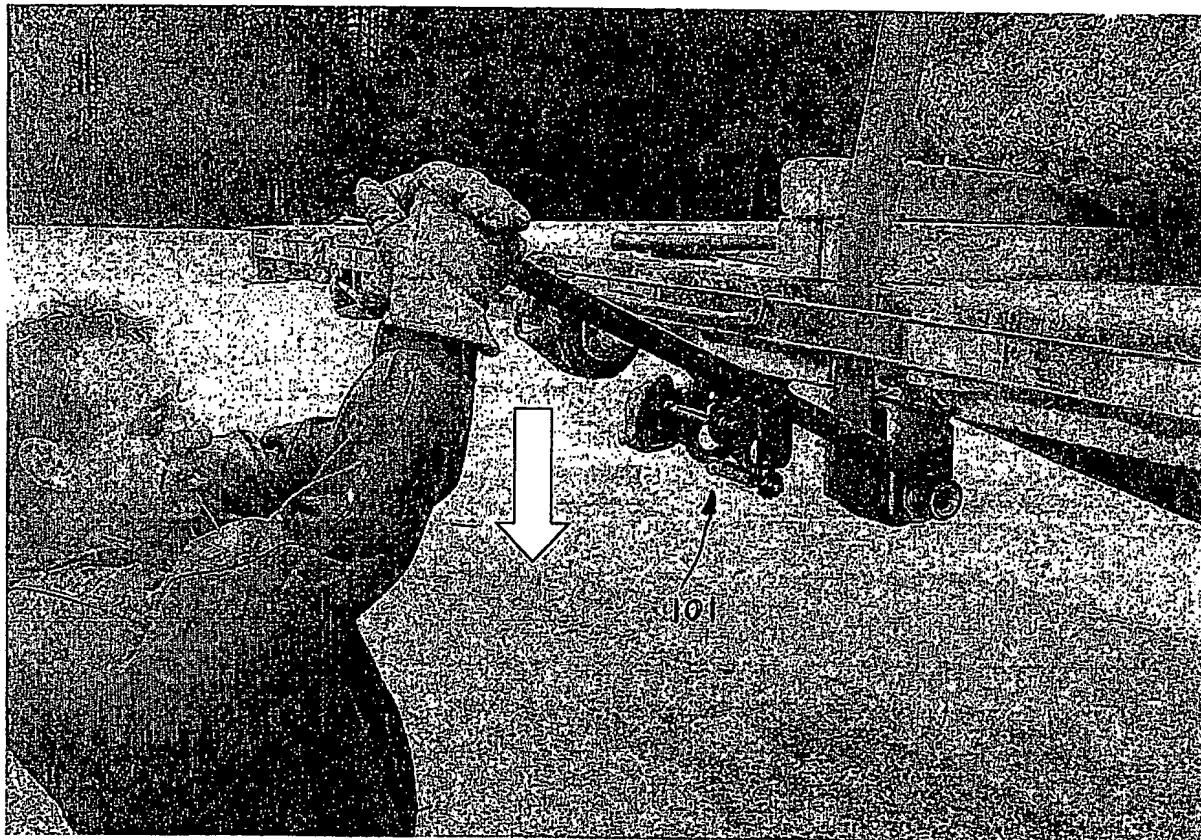


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**FIGURE 8**

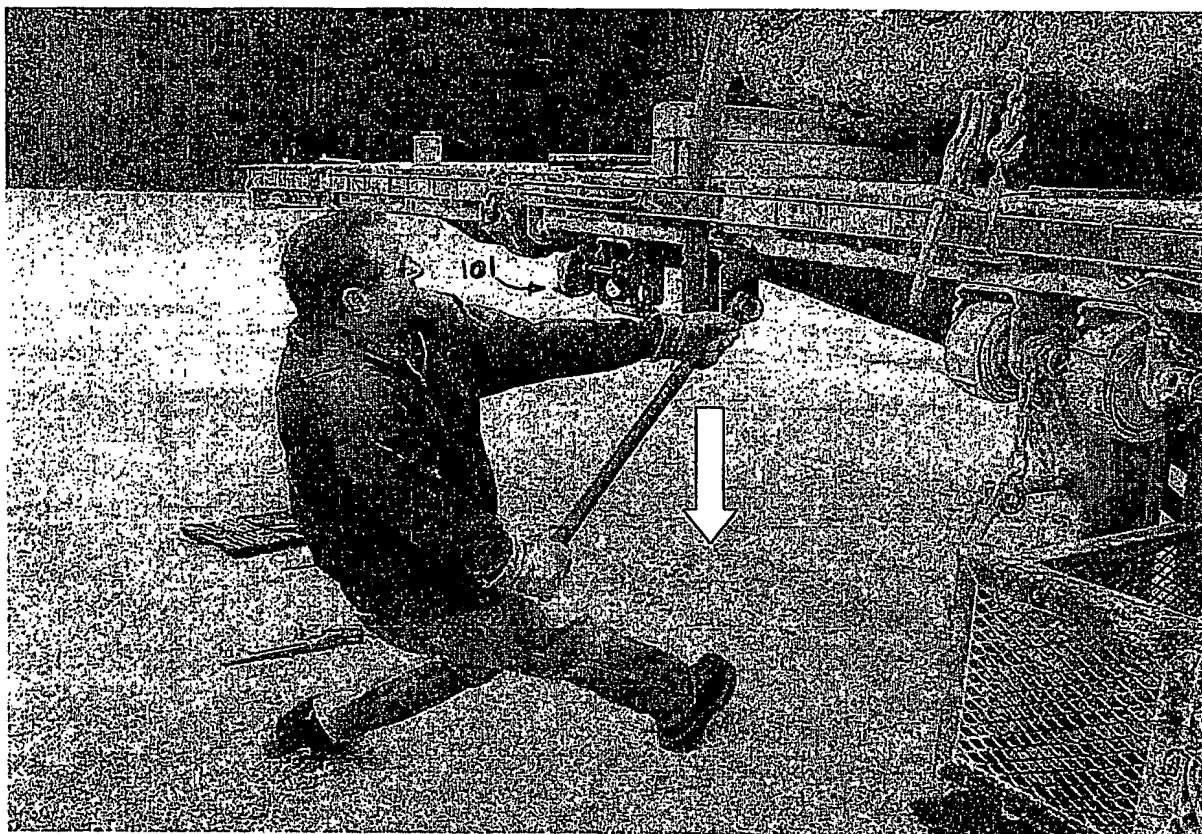


**FIGURE 9**

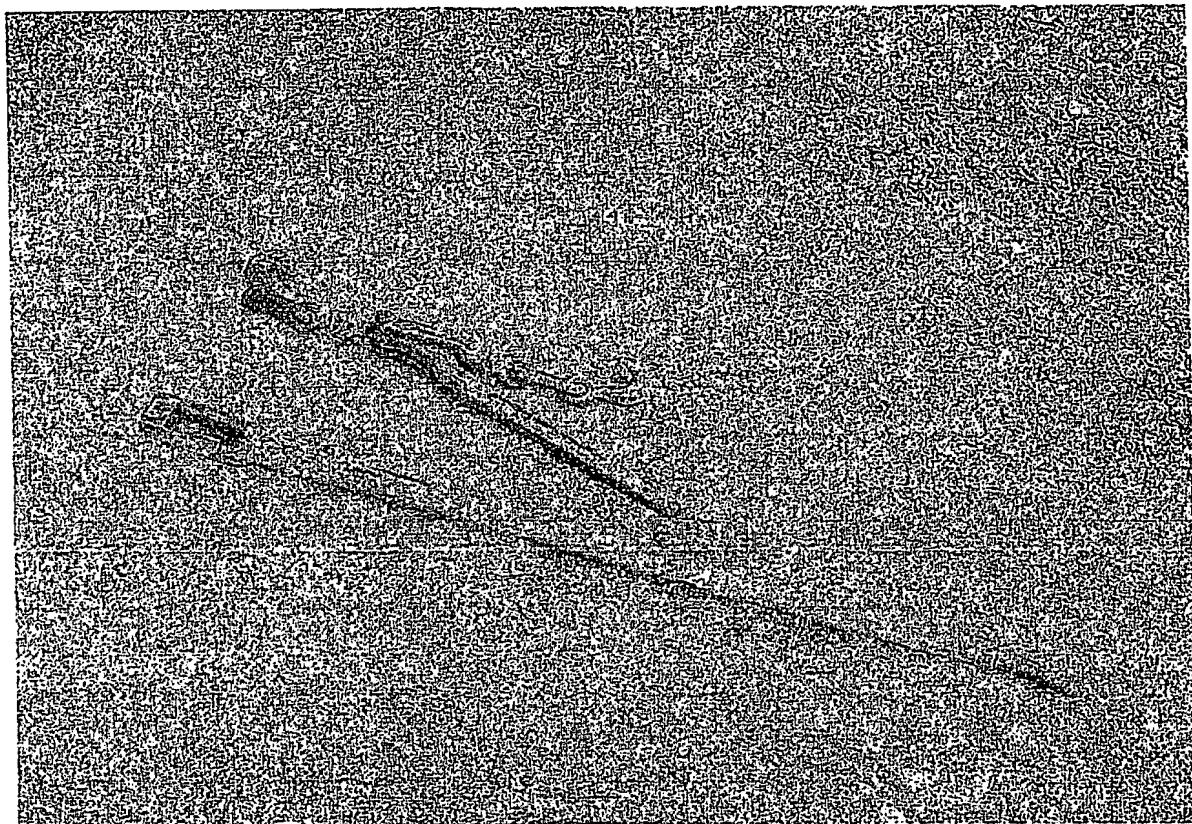


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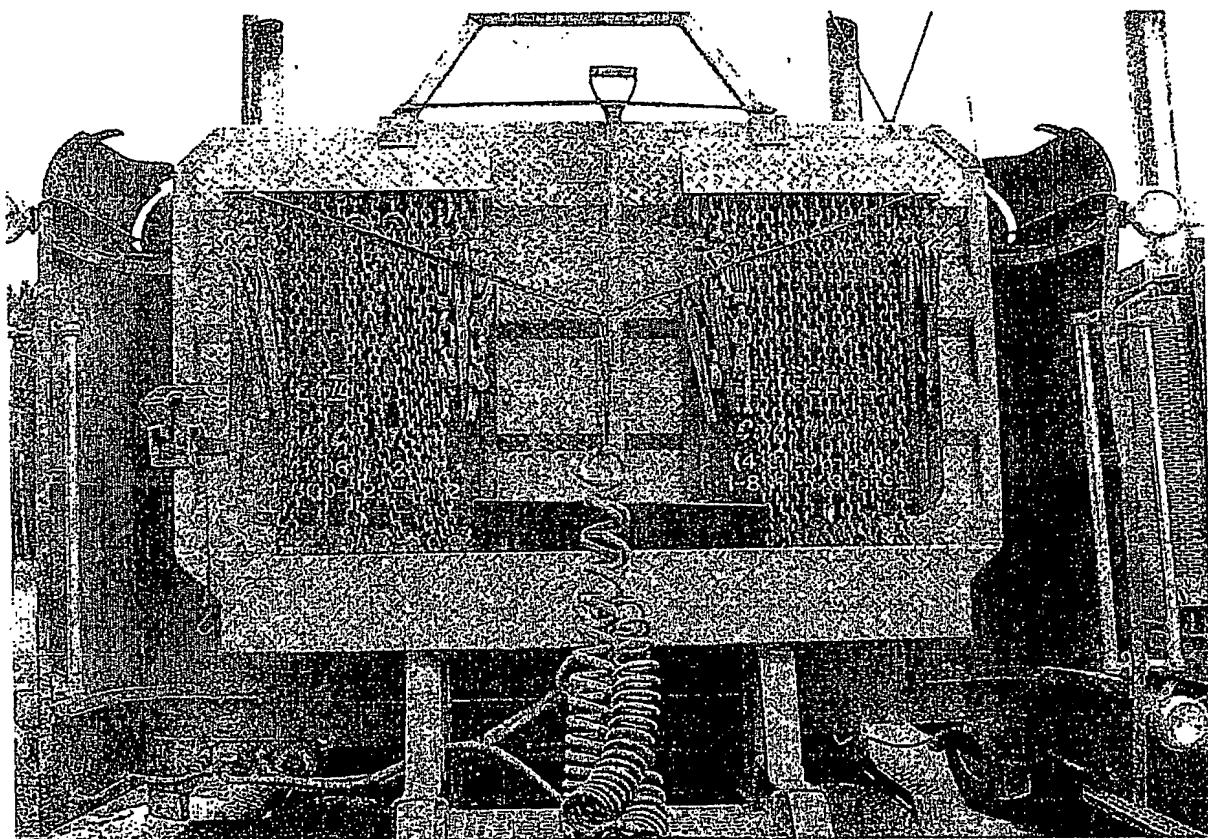
**FIGURE 10**



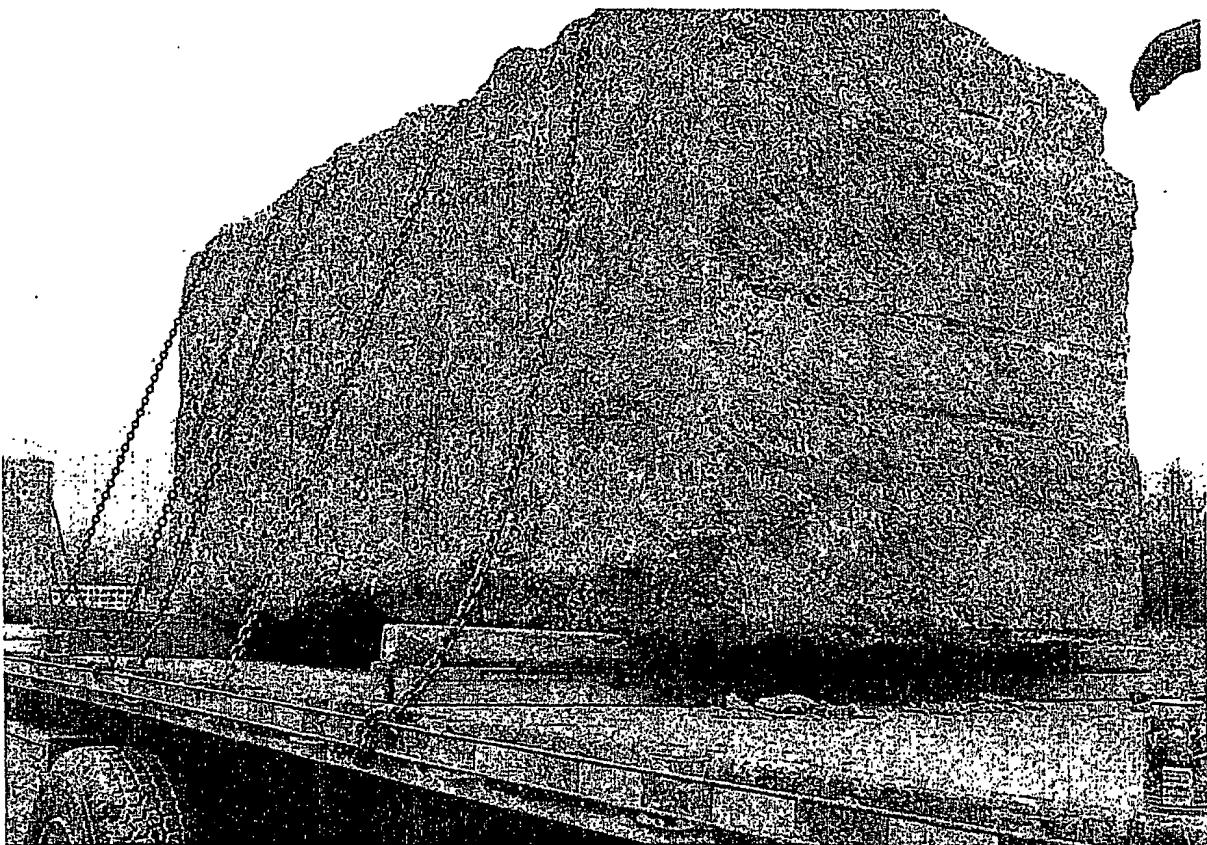
**FIGURE 11**



**FIGURE 12**



**FIGURE 13**

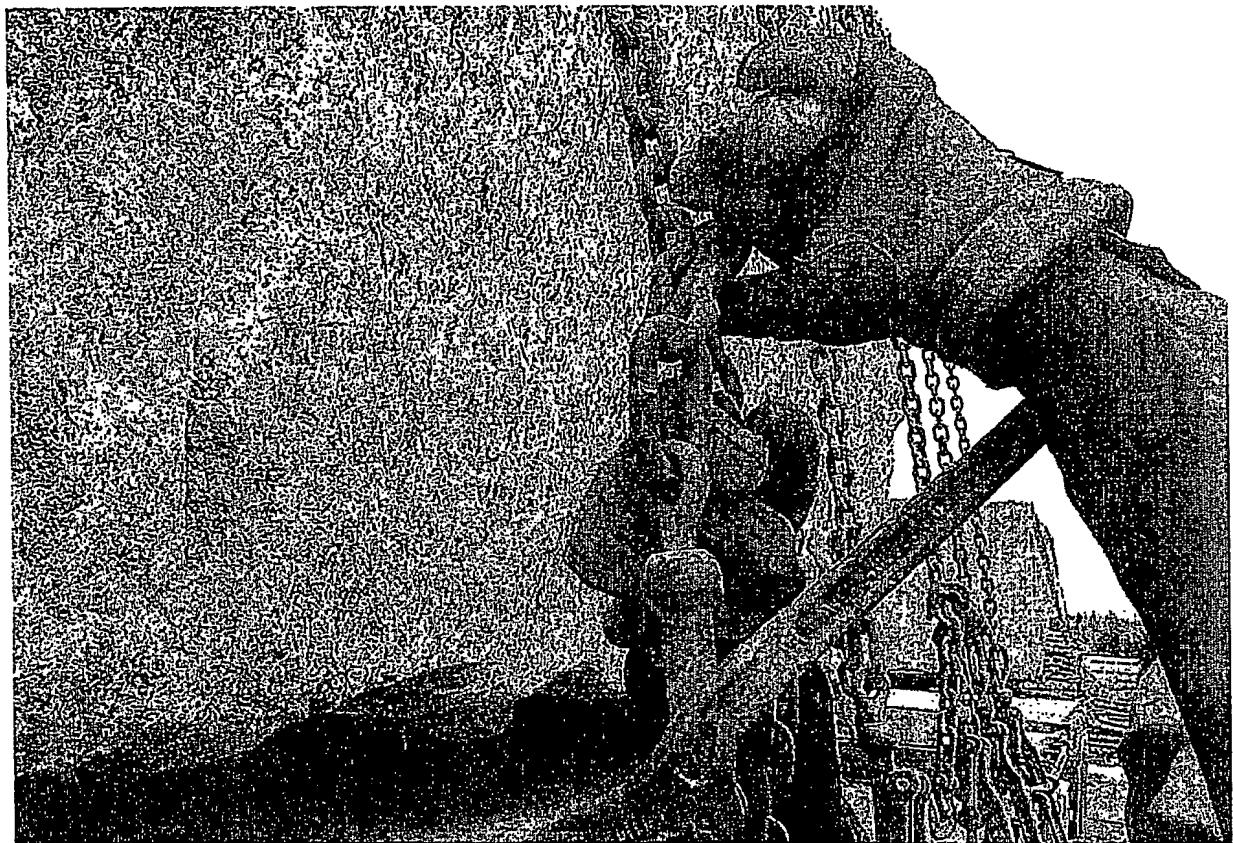


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**FIGURE 14**



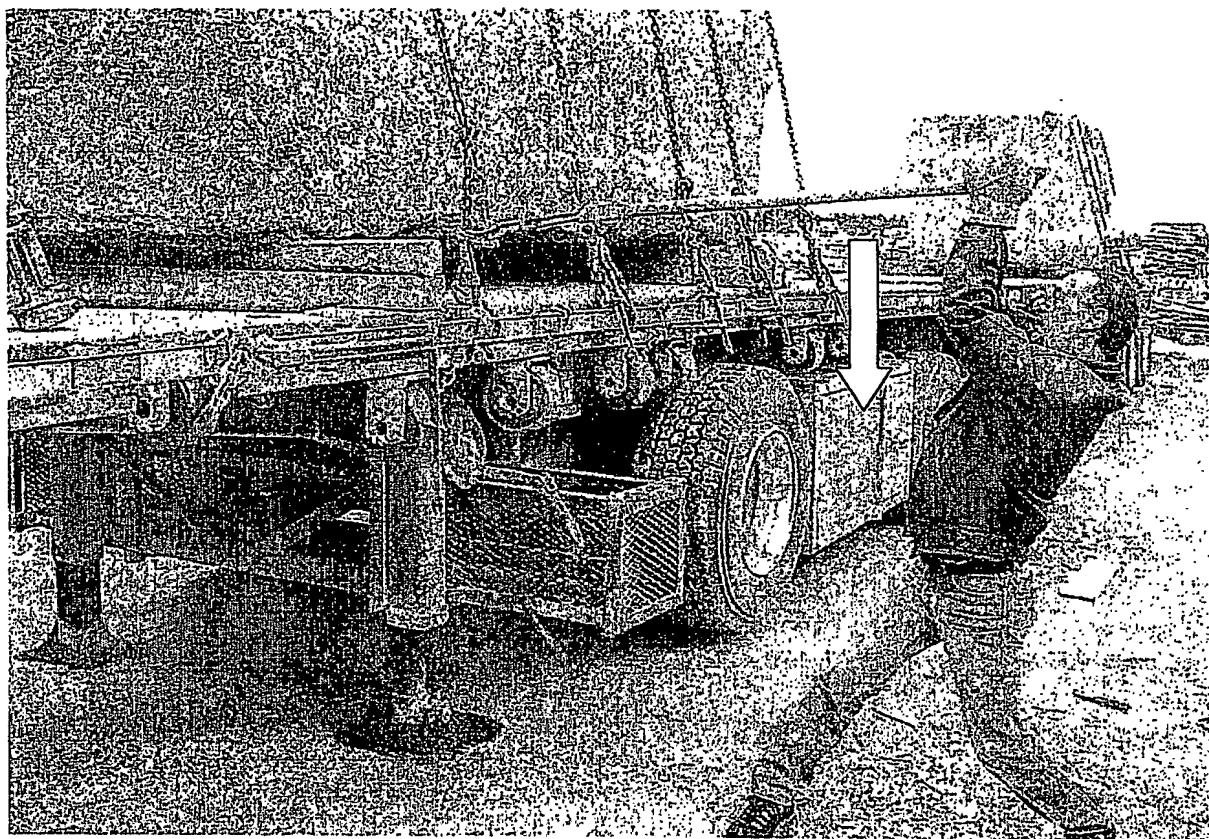
**FIGURE 15**



**FIGURE 16**

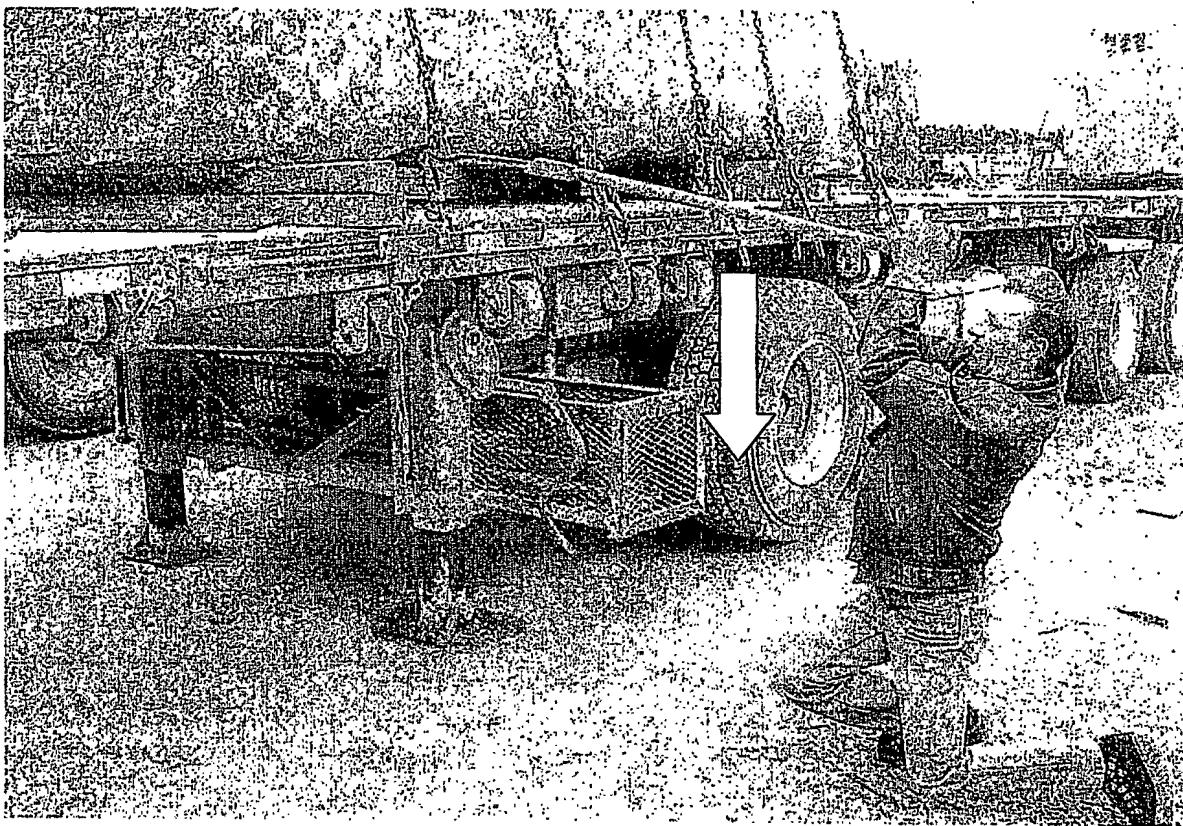


**FIGURE 17**



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**FIGURE 18**



**FIGURE 19**



**FIGURE 20**

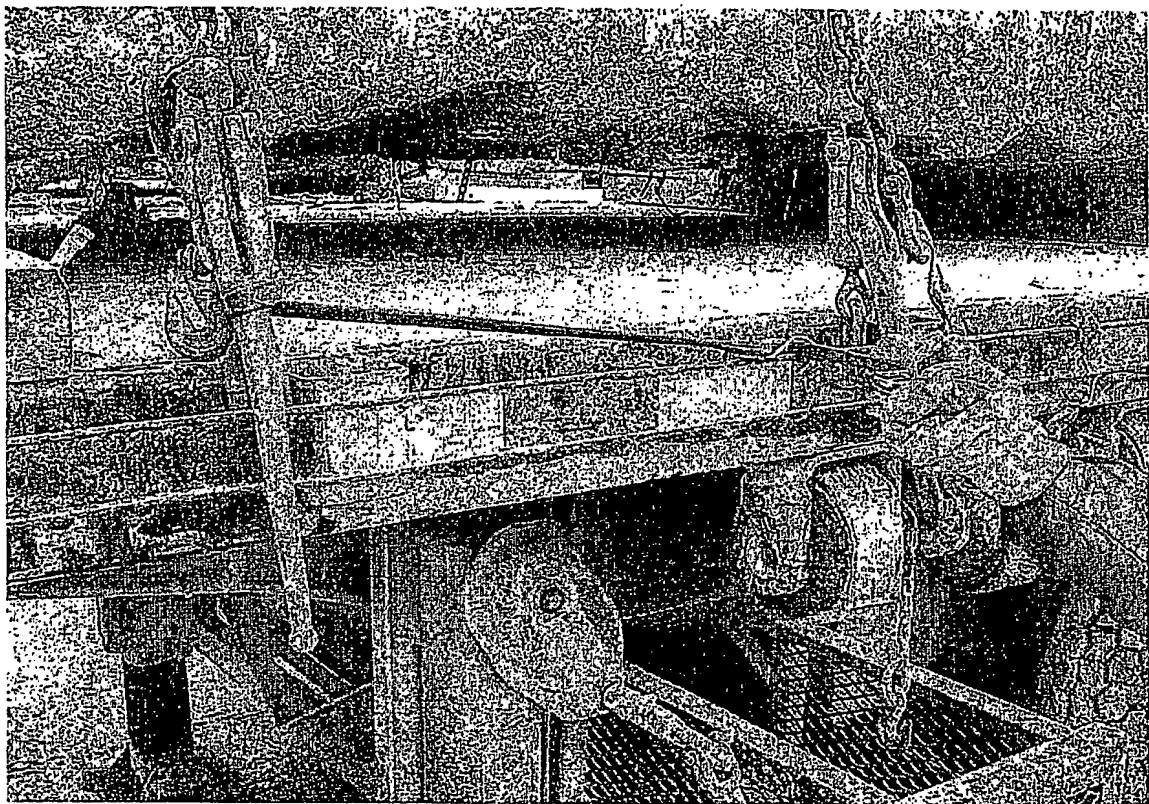
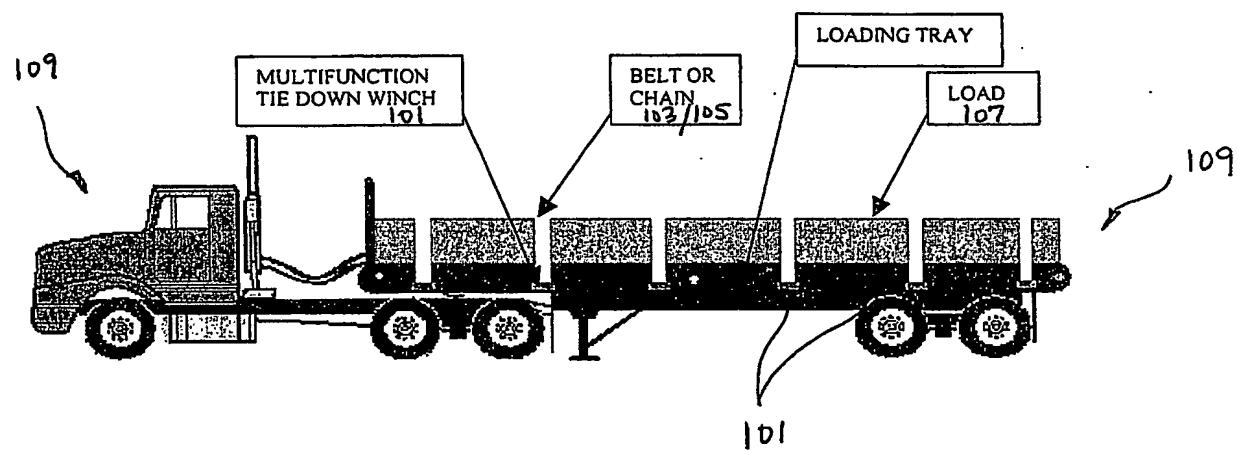
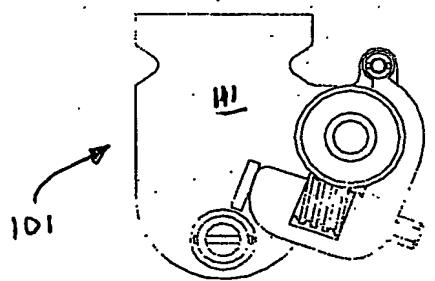
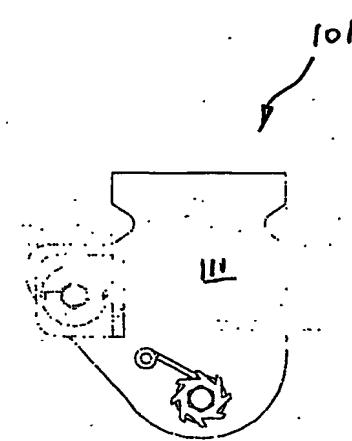
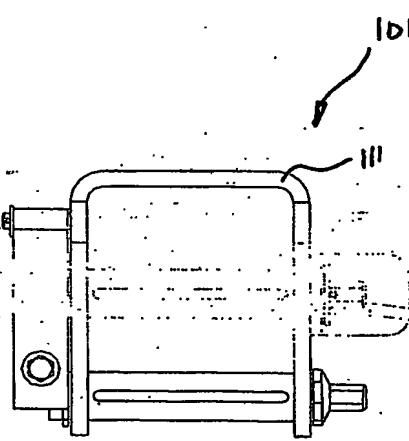
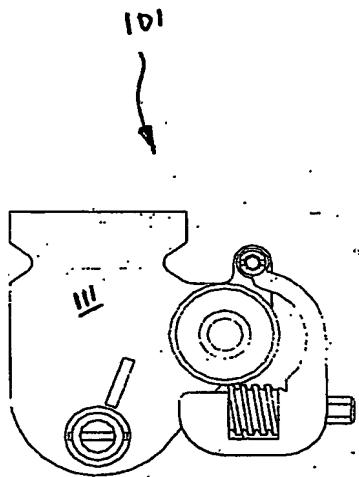


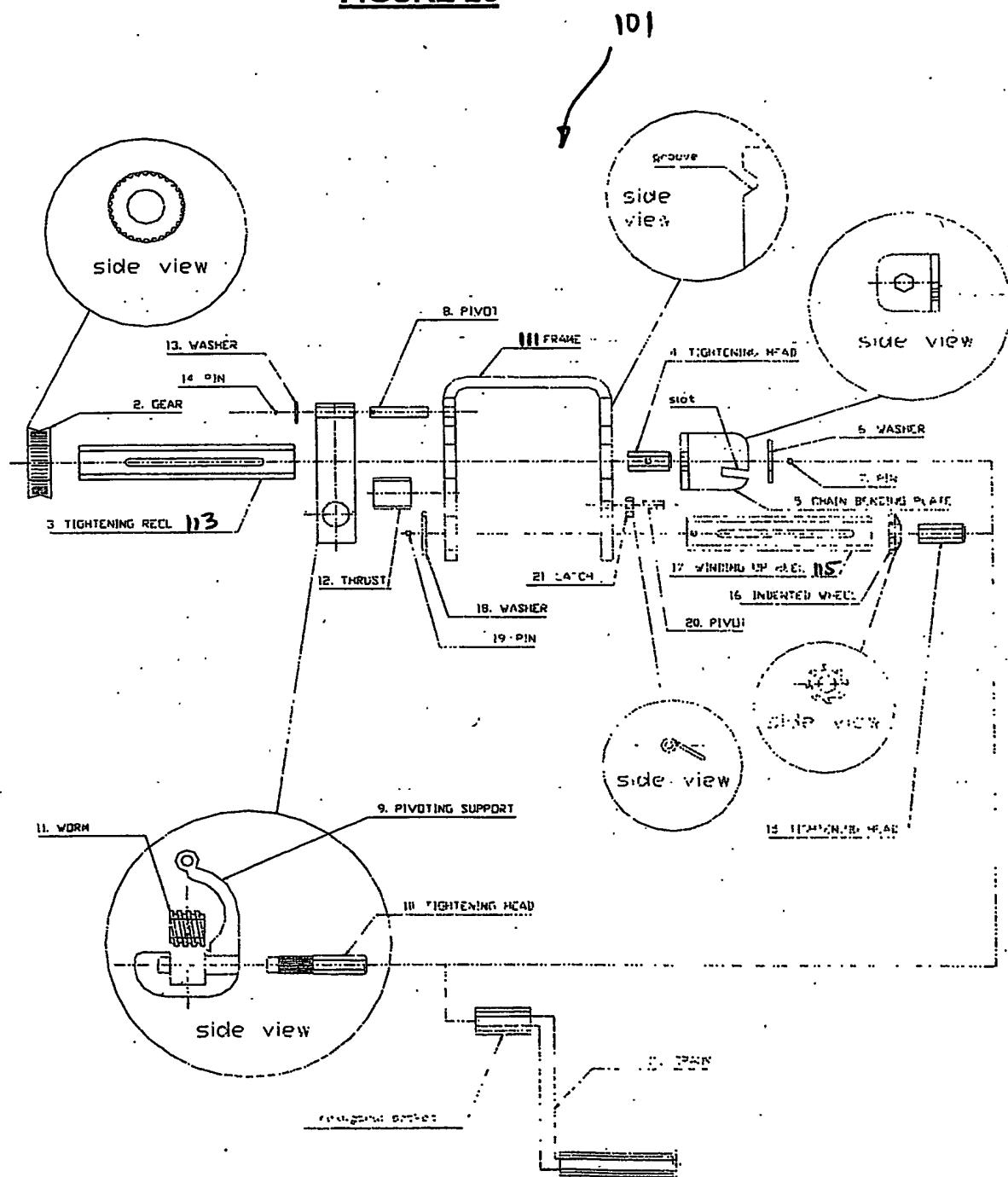
FIGURE 21



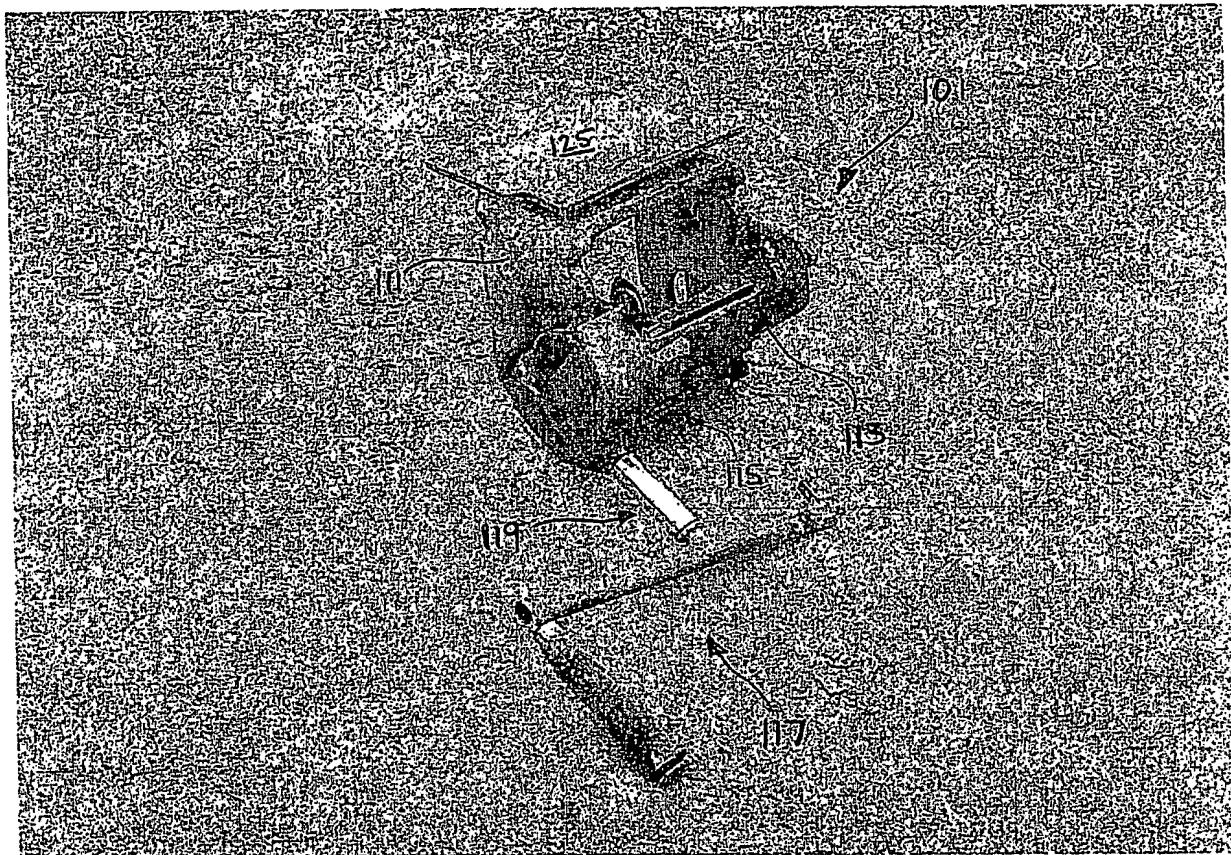
## **FIGURES 22-25**



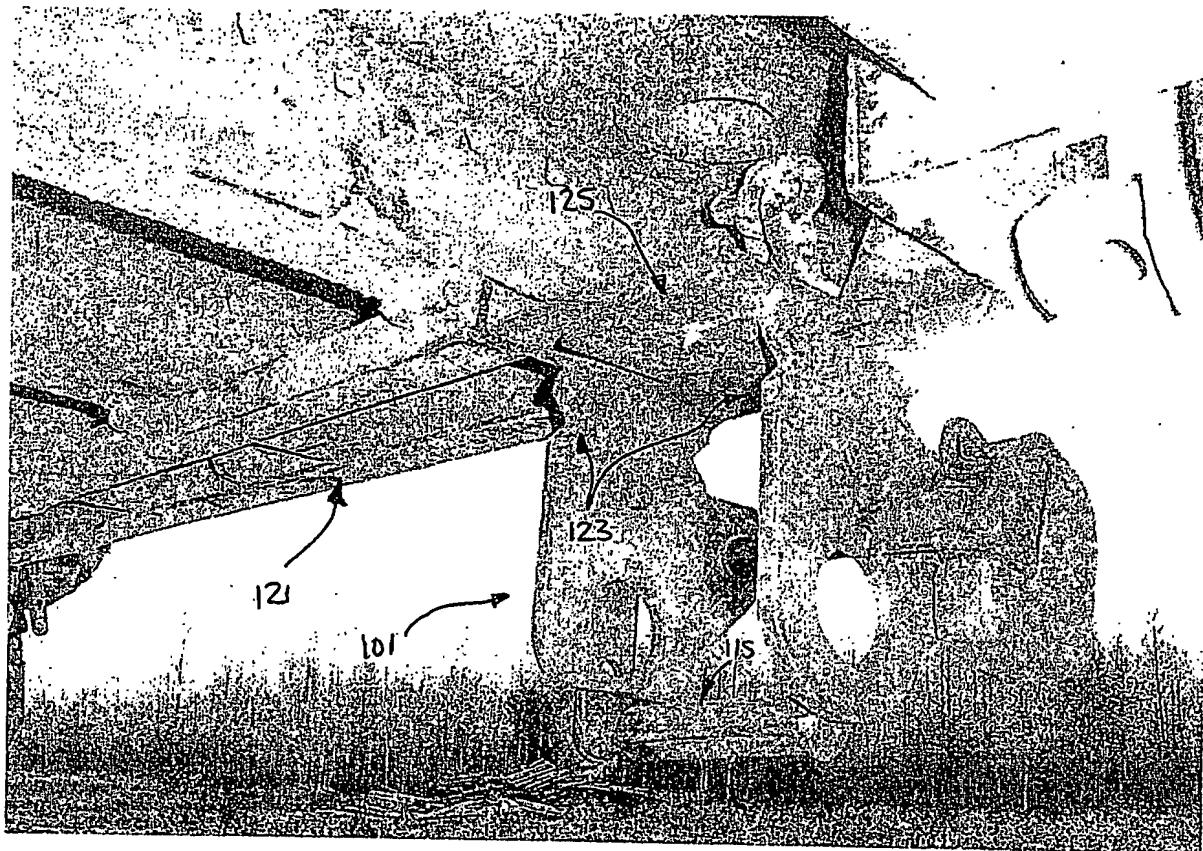
**FIGURE 26**



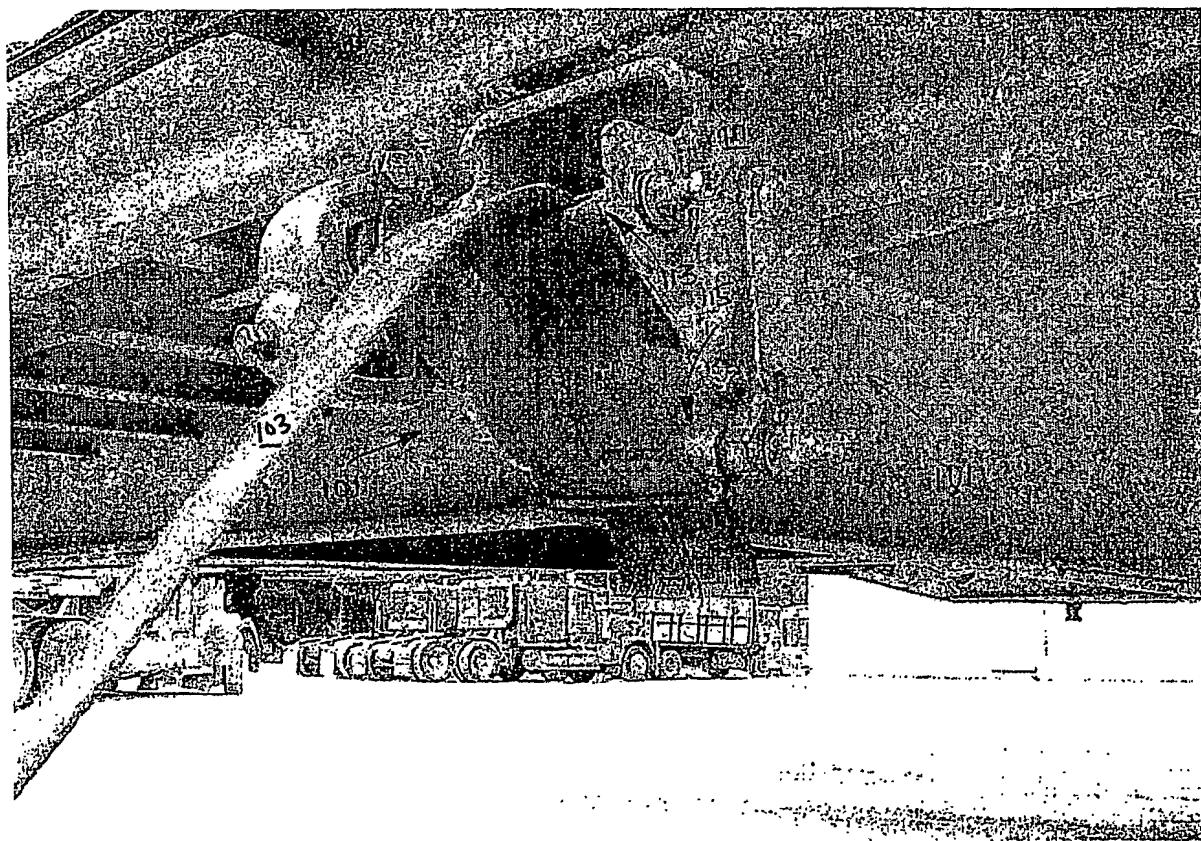
**FIGURE 27**



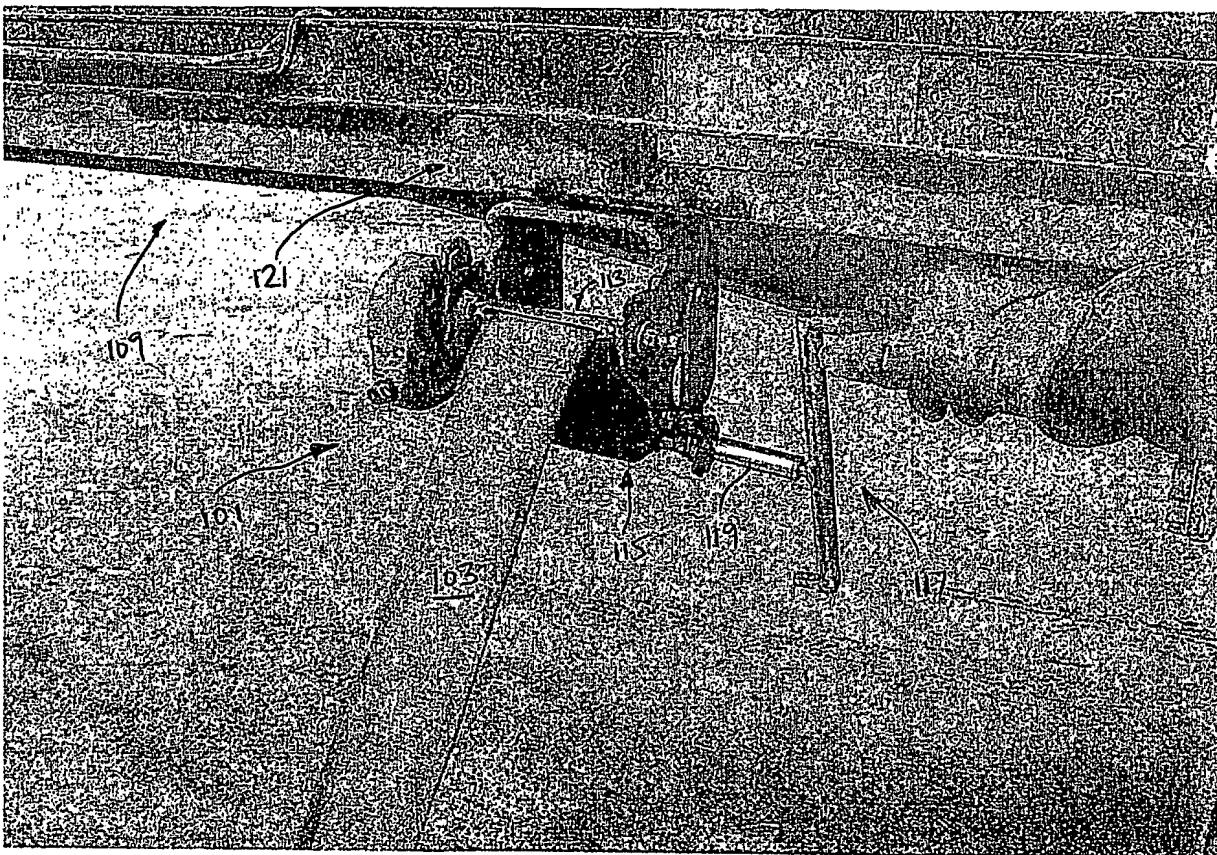
**FIGURE 28**



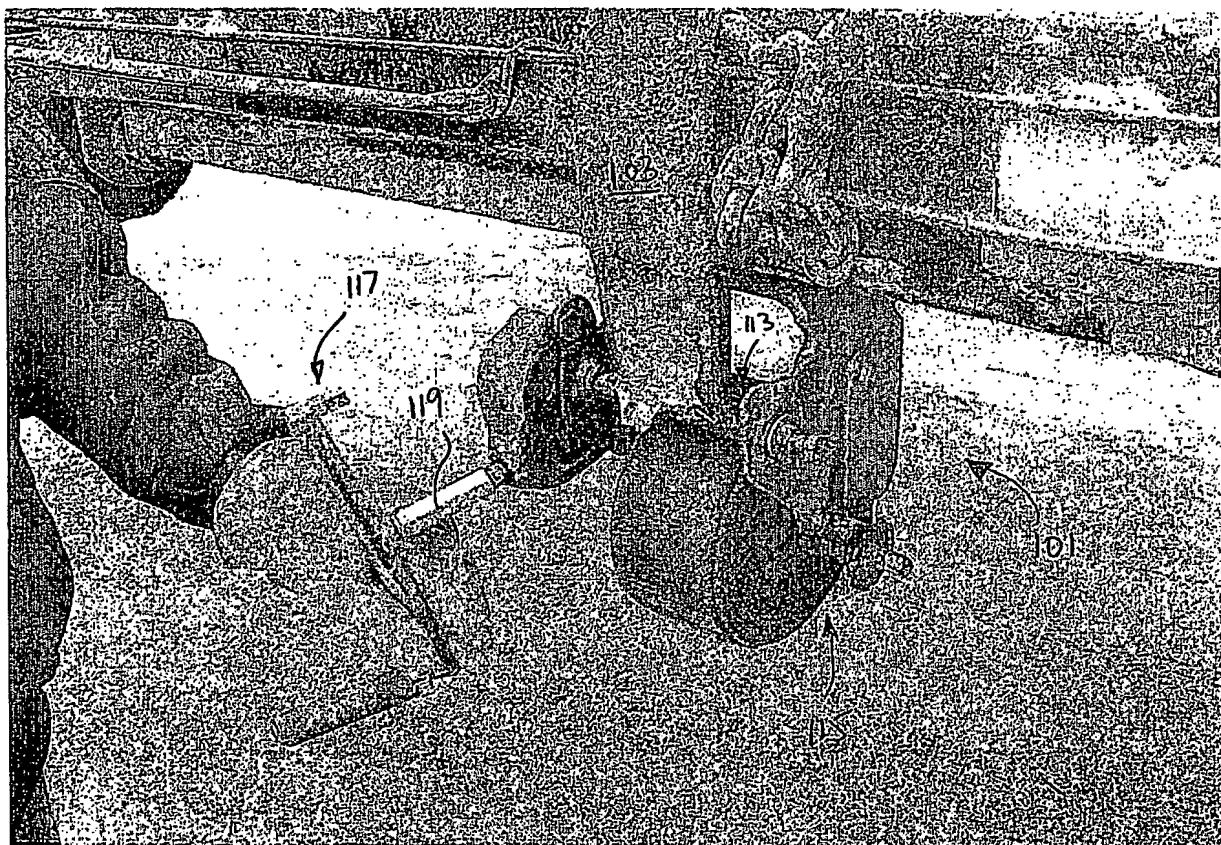
**FIGURE 29**



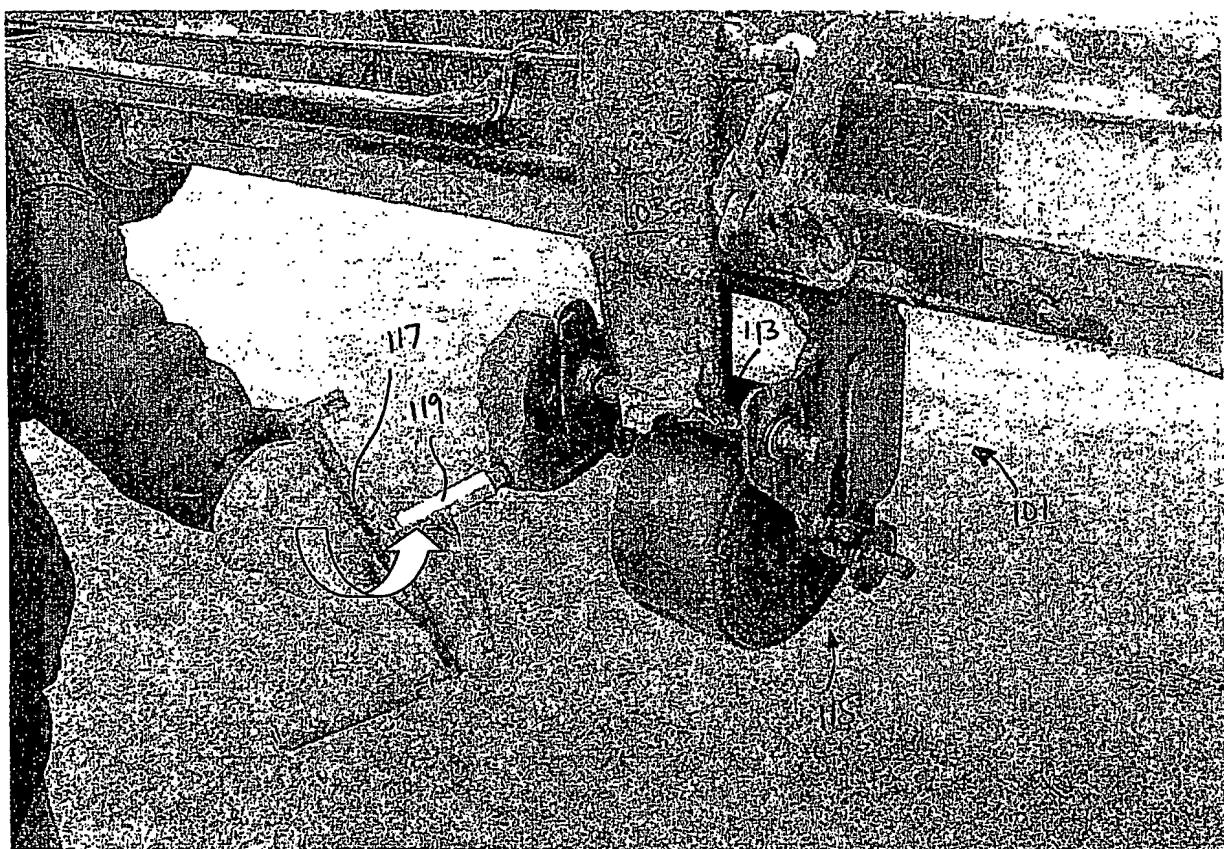
**FIGURE 30**



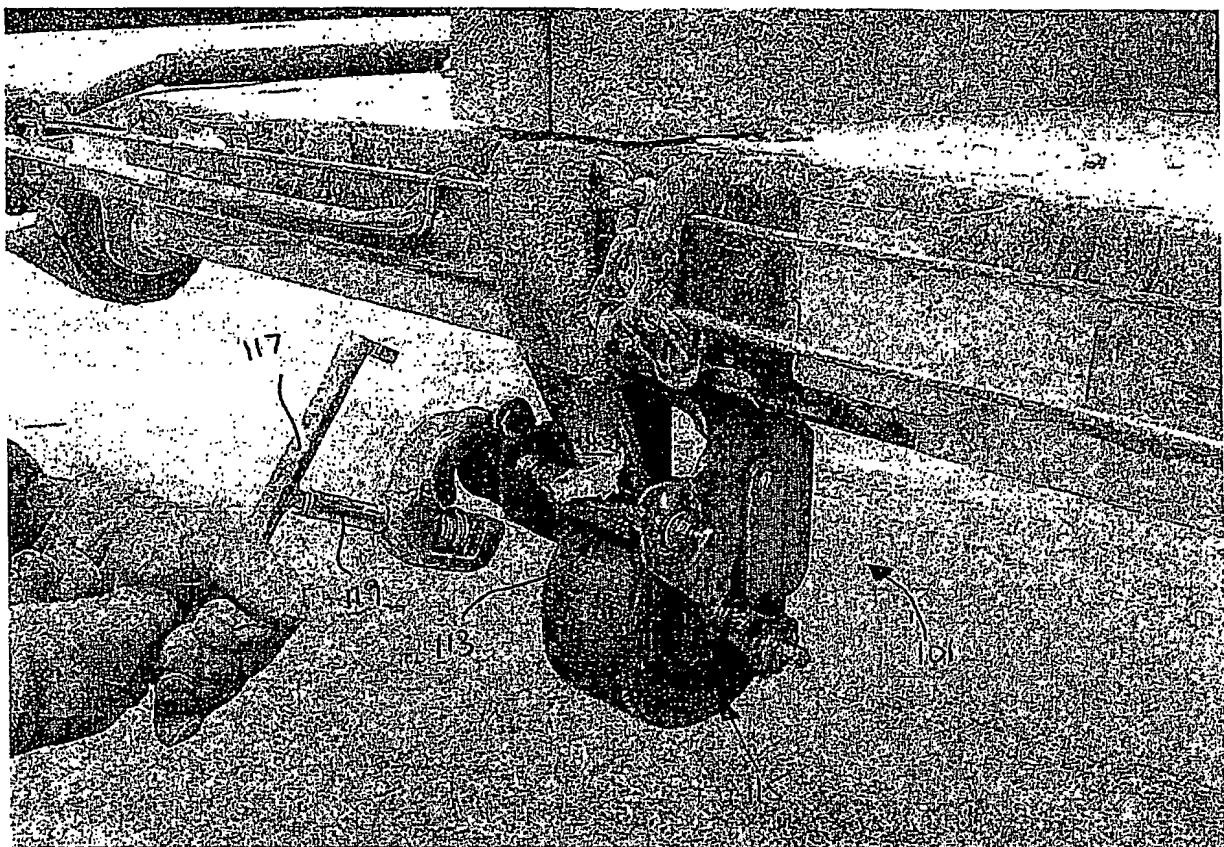
**FIGURE 31**



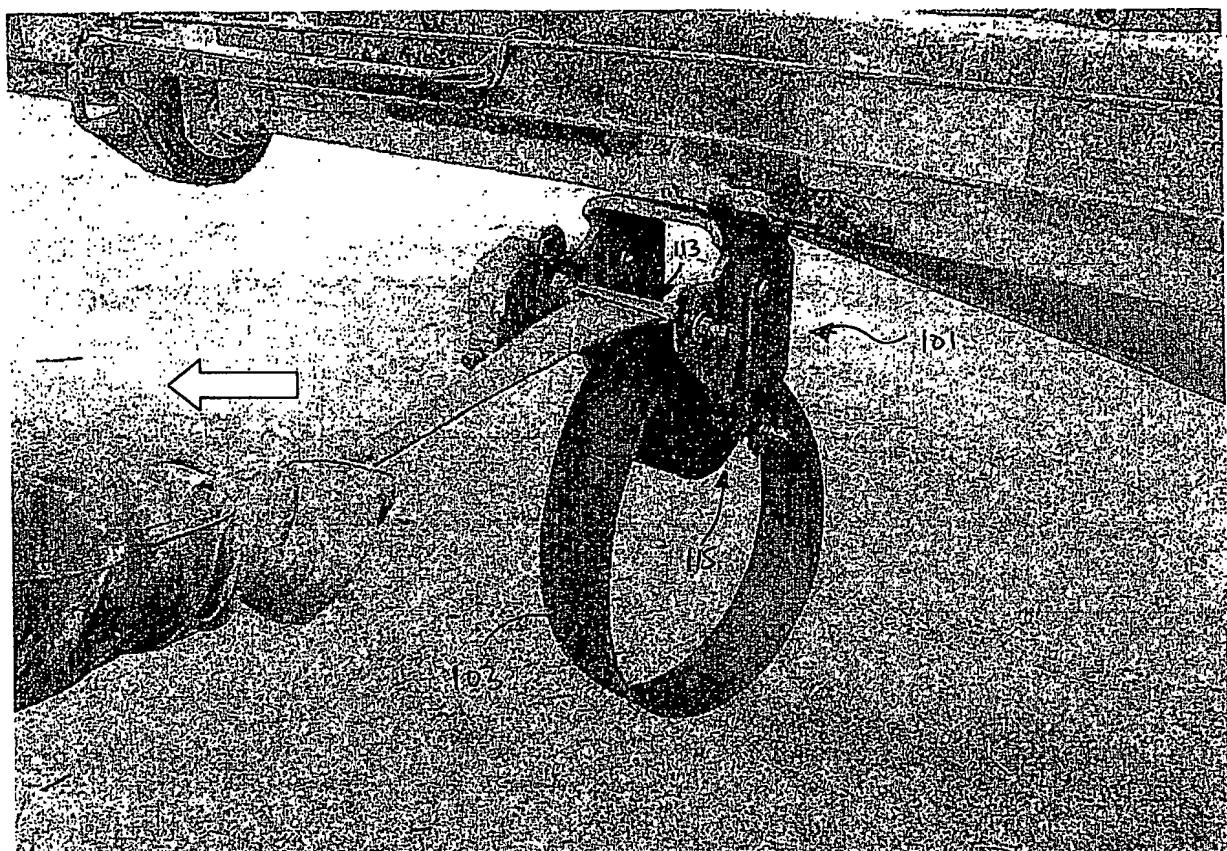
**FIGURE 32**



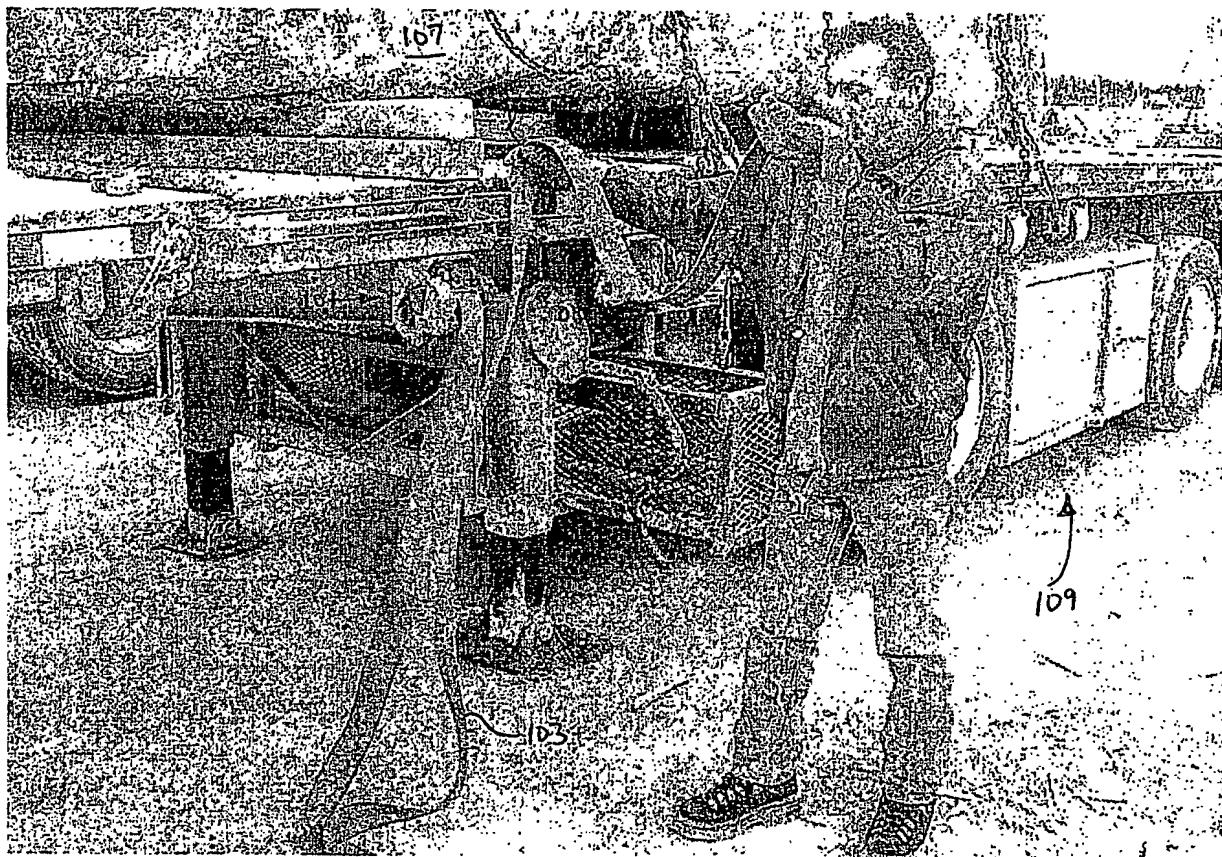
**FIGURE 33**



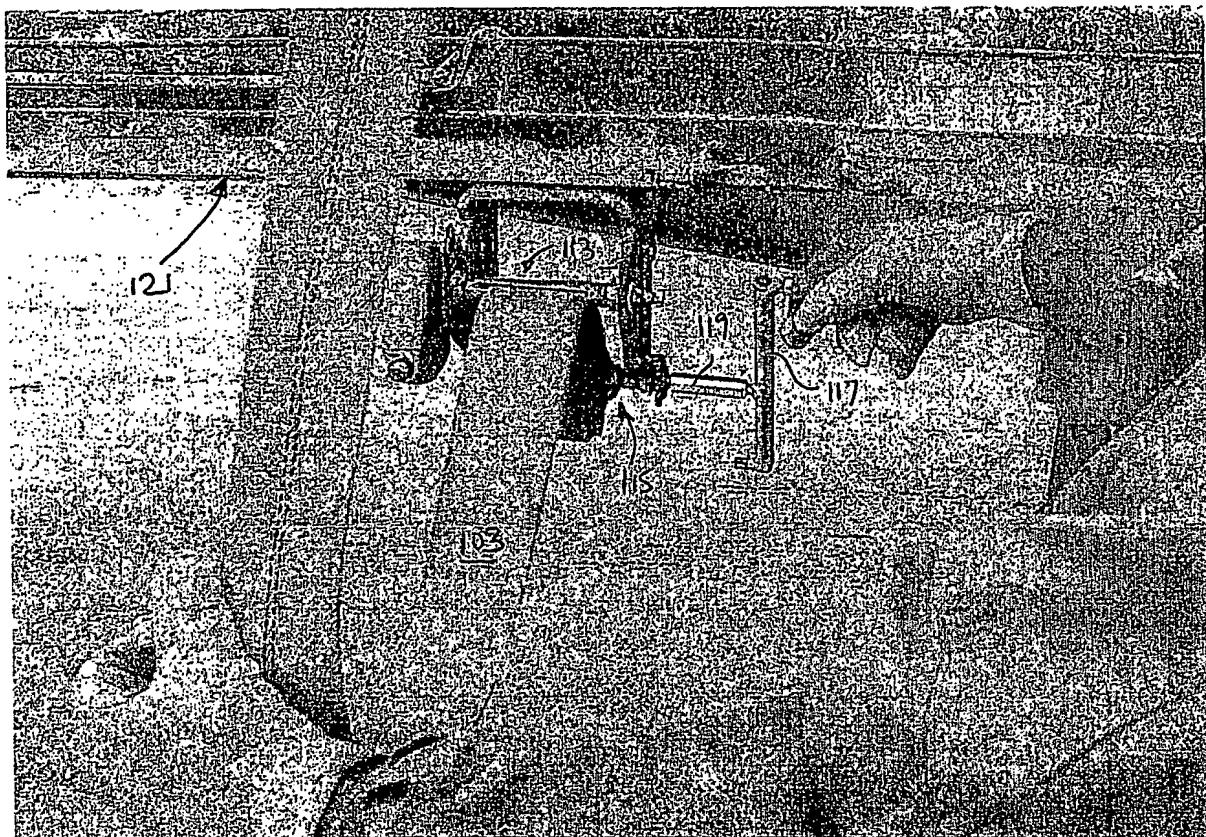
**FIGURE 34**



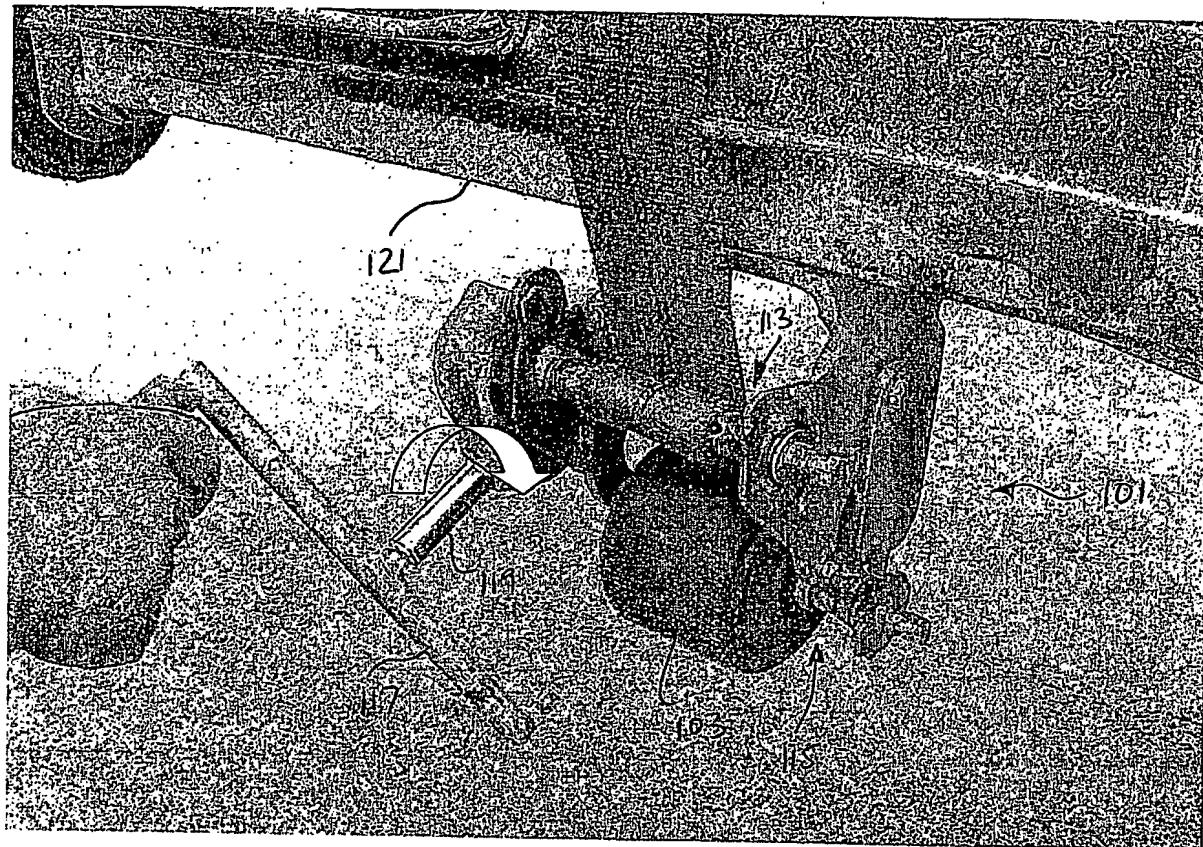
**FIGURE 35**



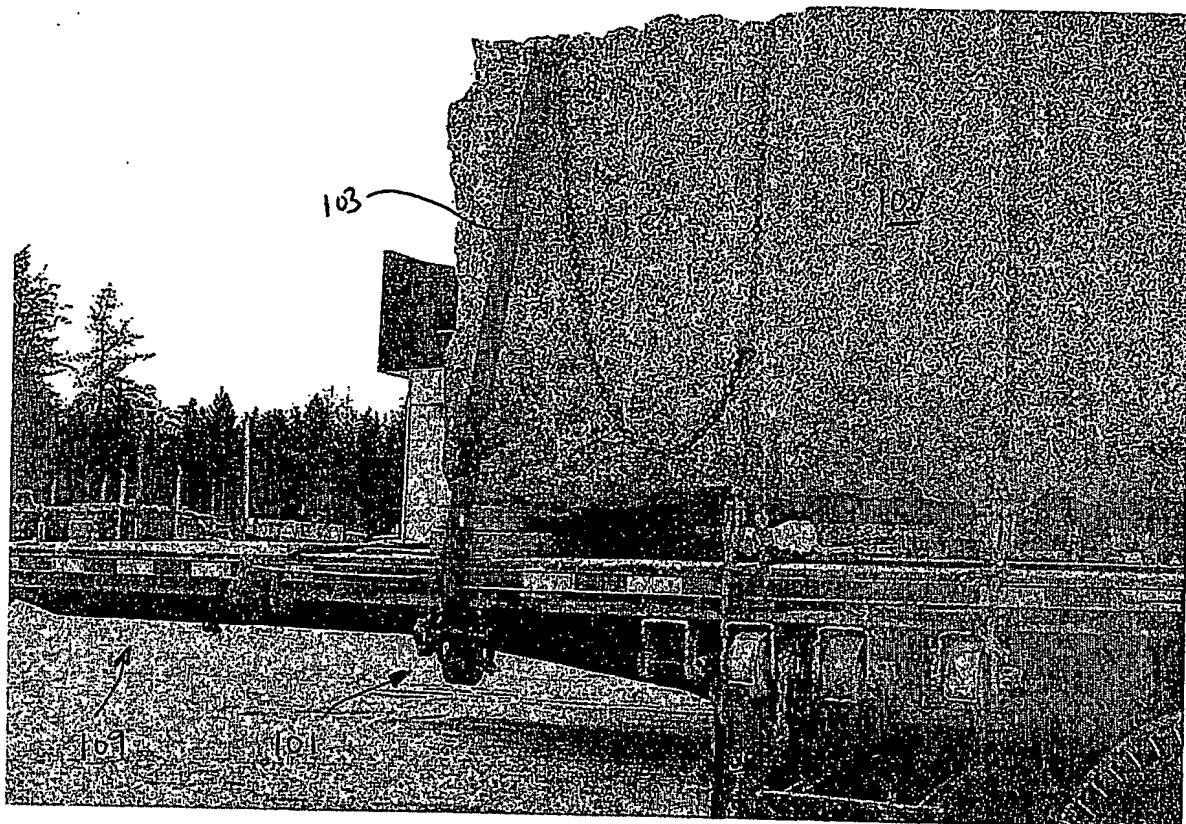
**FIGURE 36**



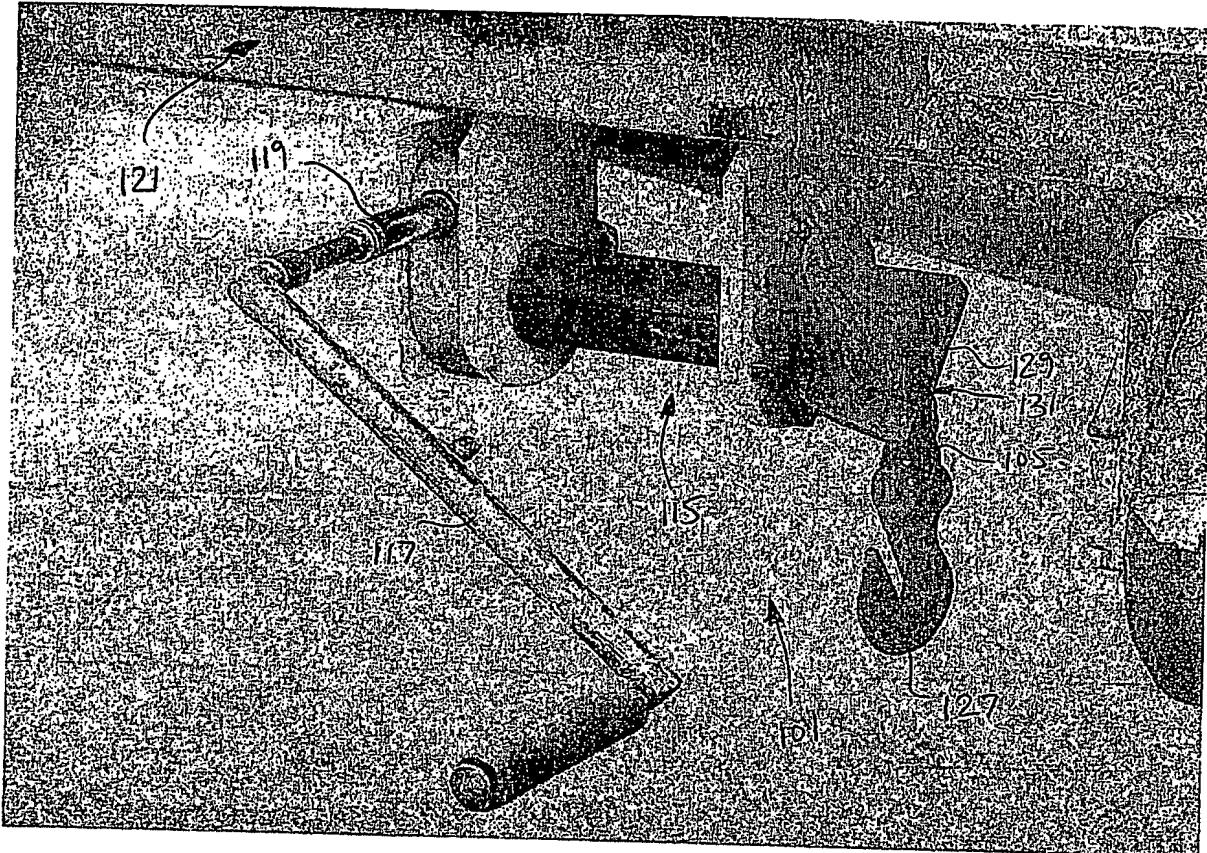
**FIGURE 37**



**FIGURE 38**

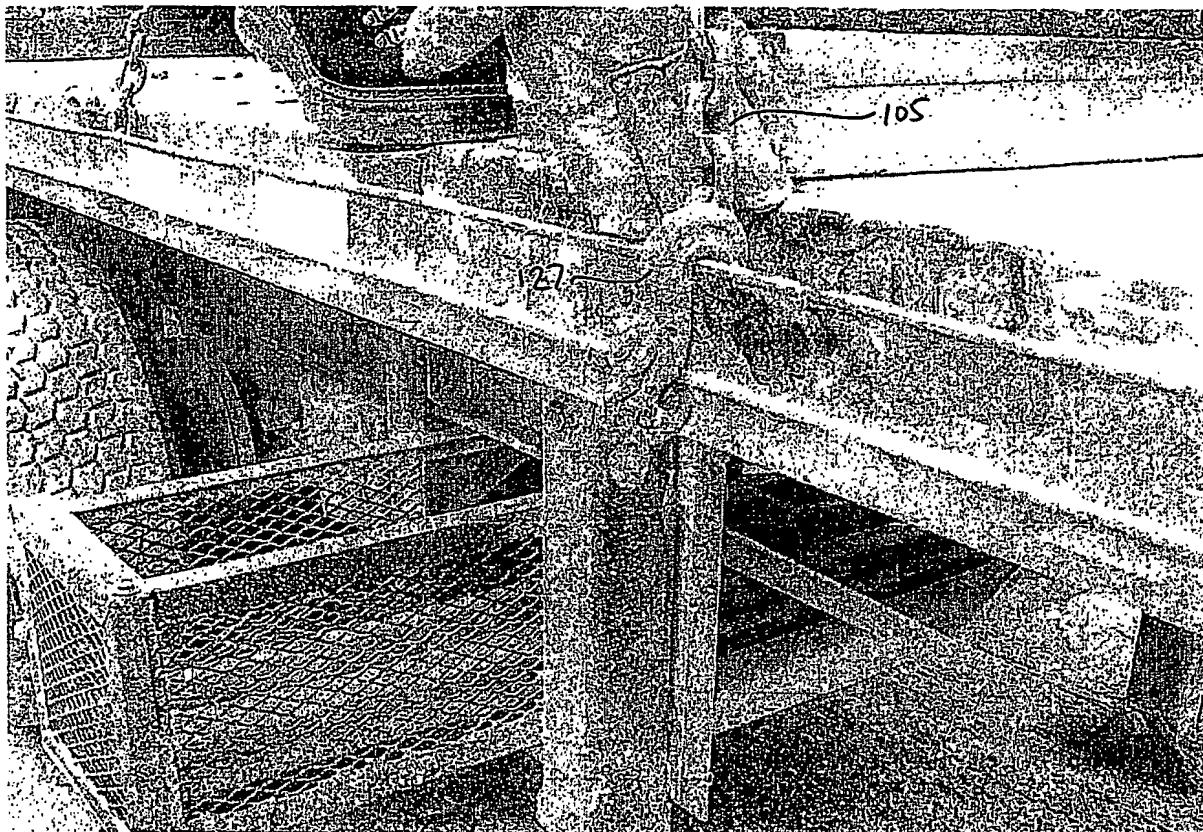


**FIGURE 39**

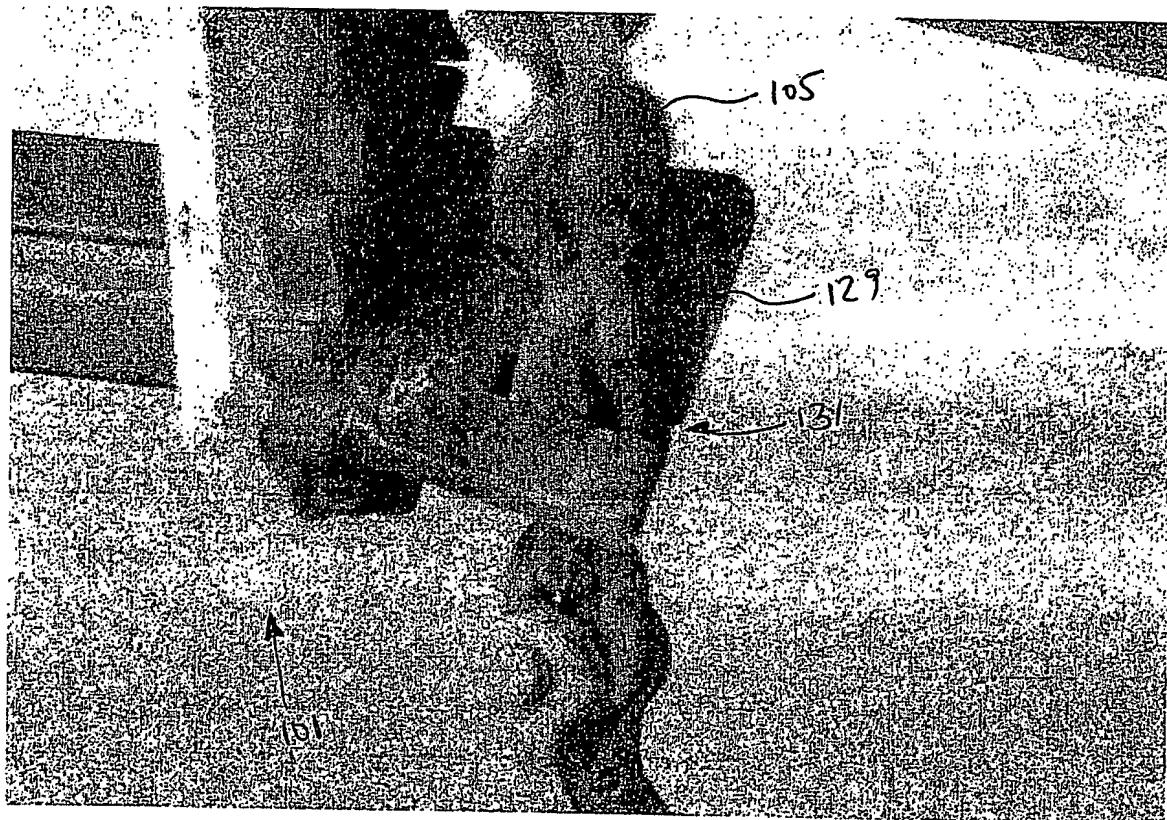


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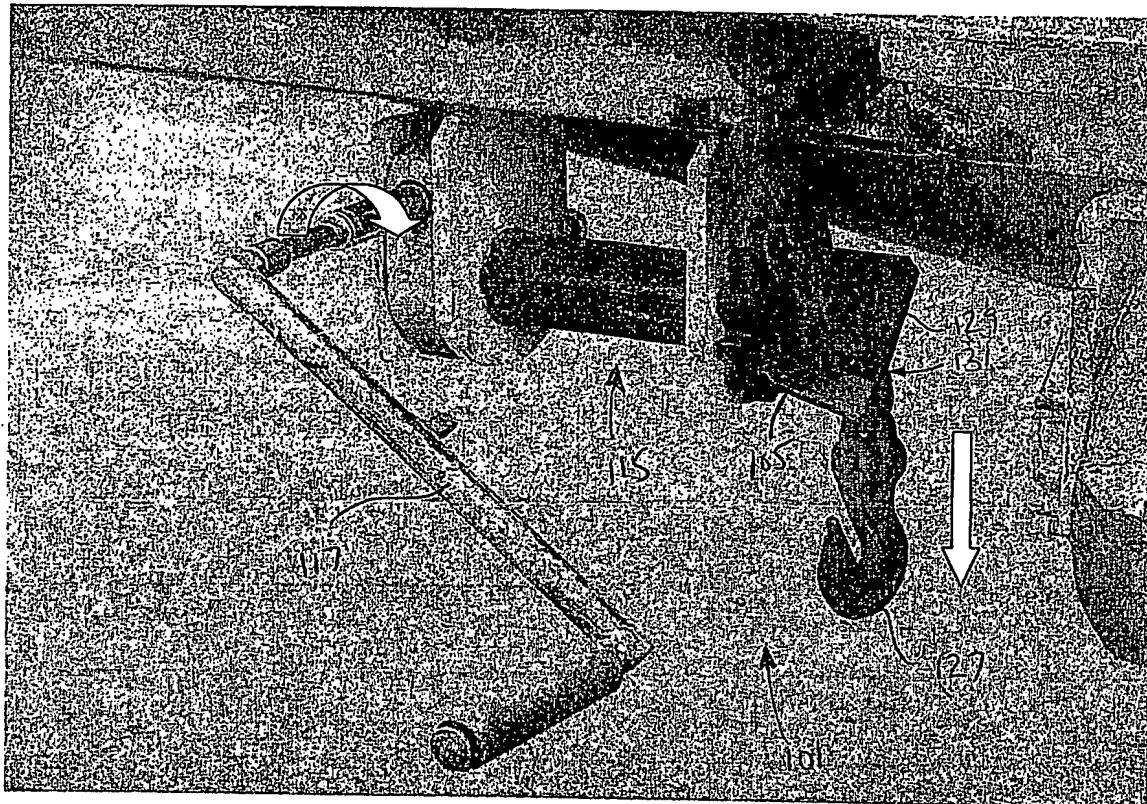
**FIGURE 40**



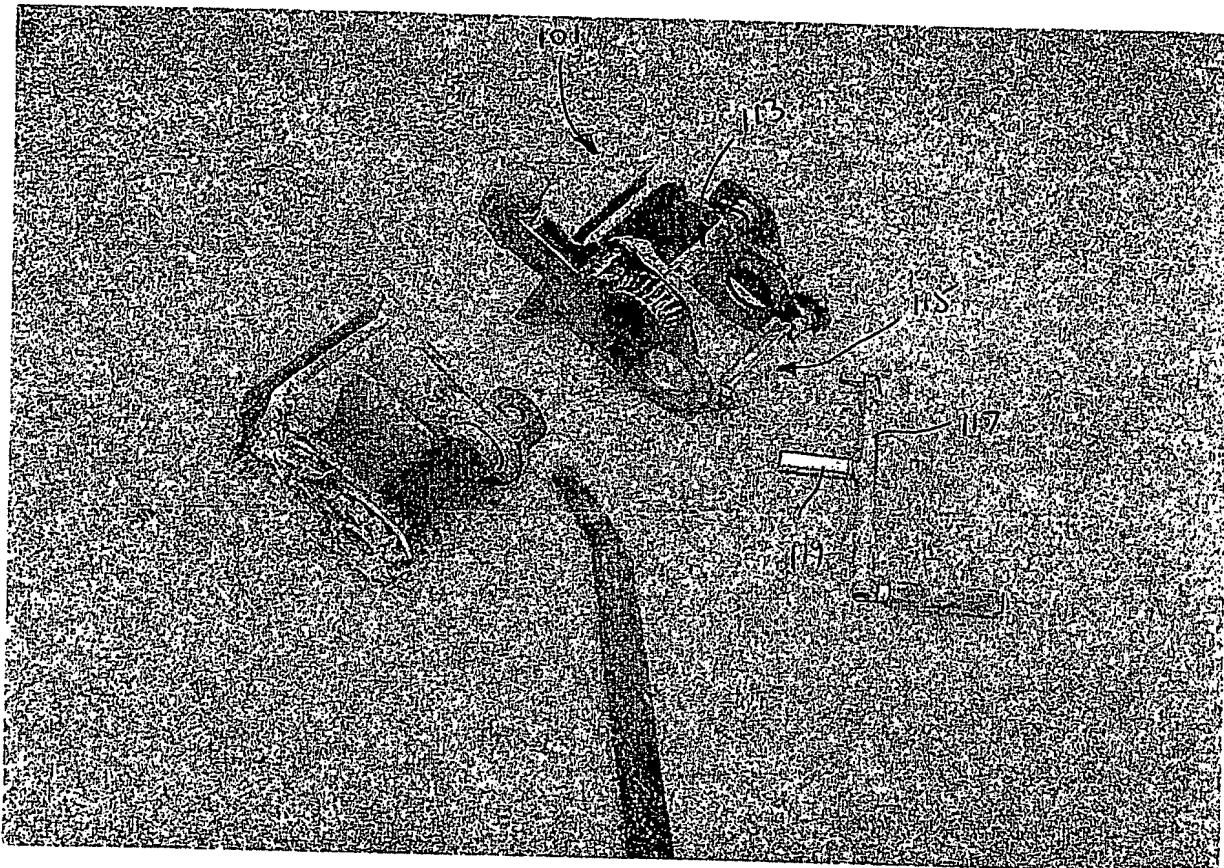
**FIGURE 41**



**FIGURE 42**

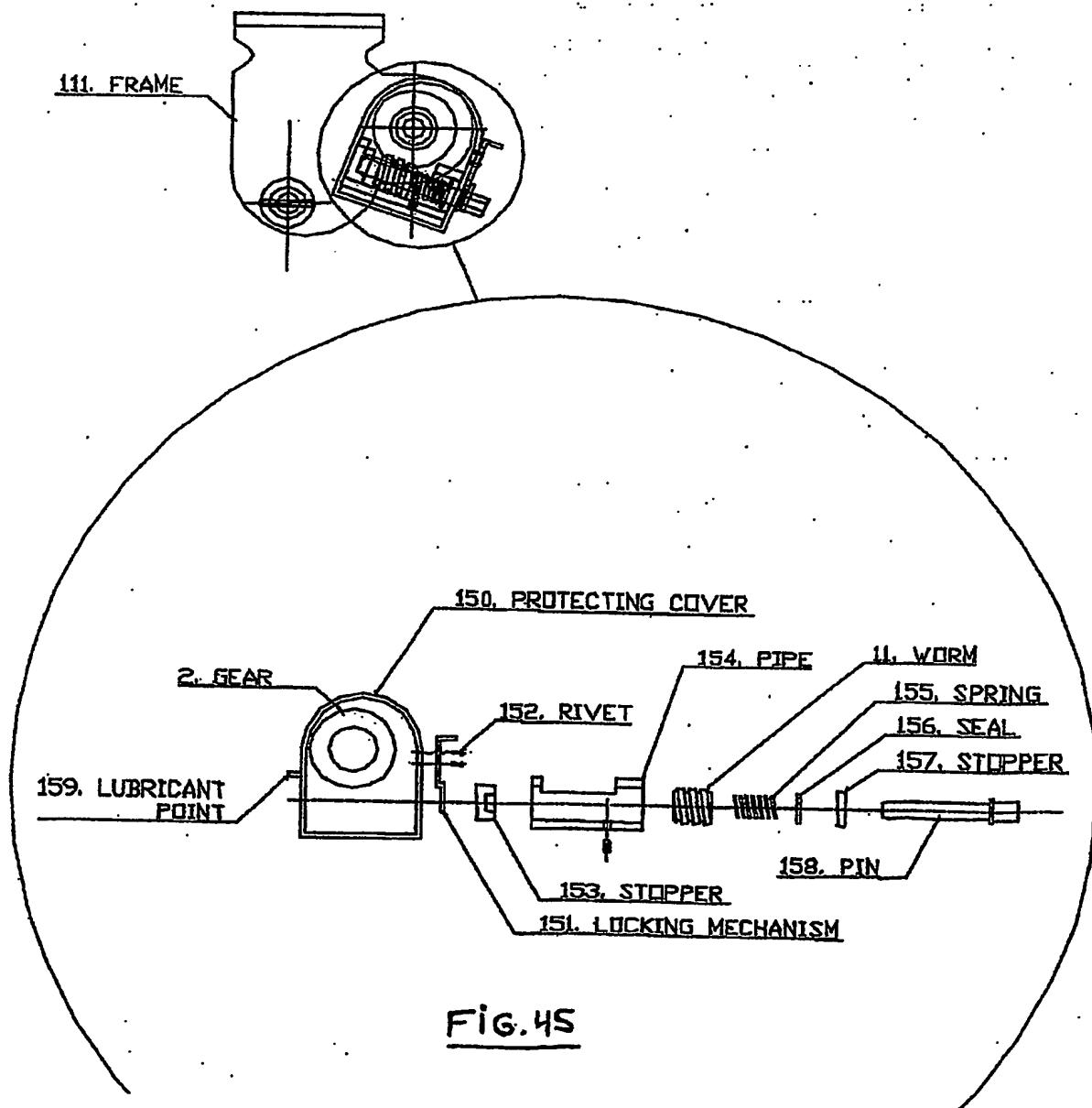


**FIGURE 43**



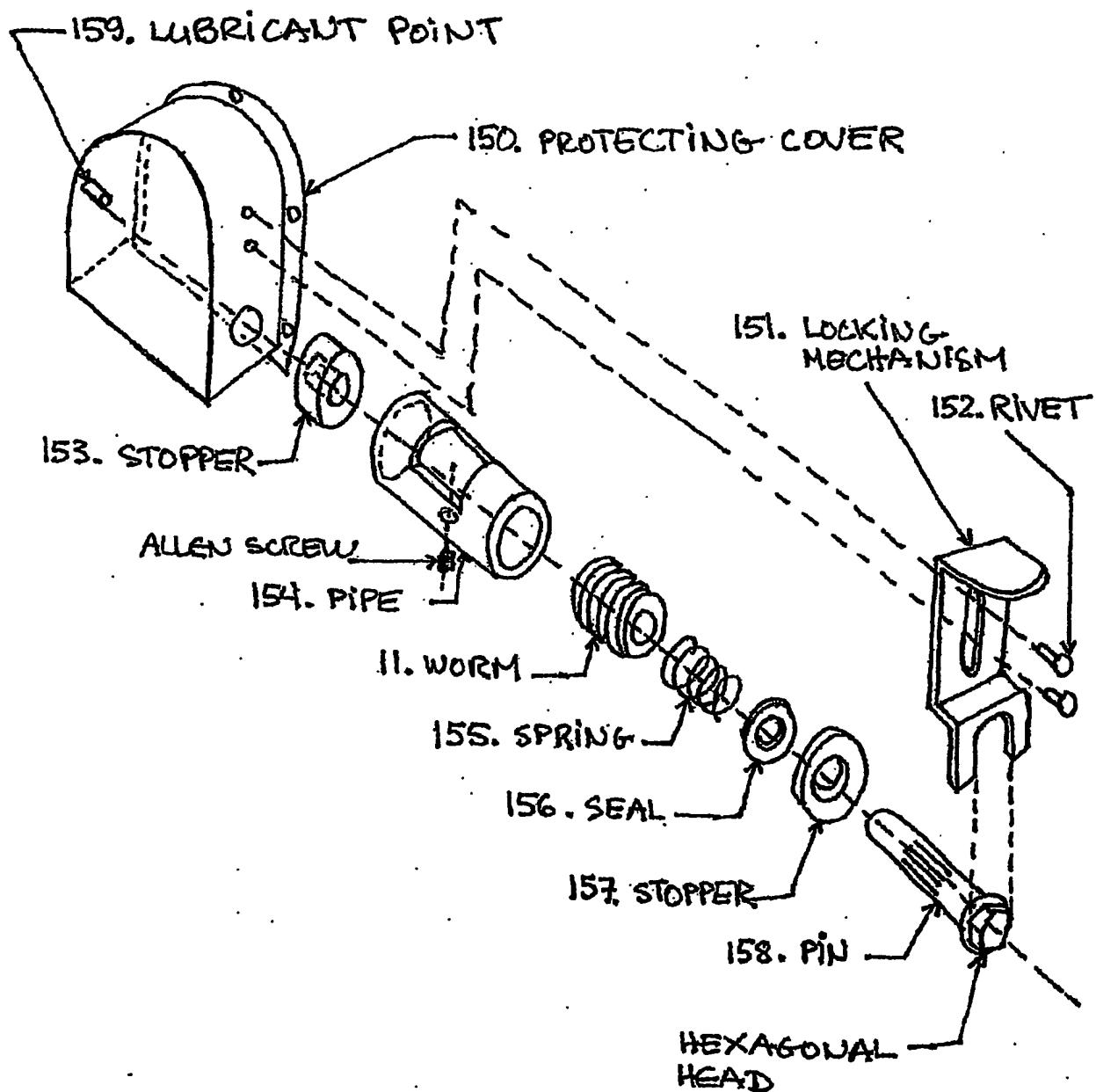
**FIGURE 44**

LEFT SIDE VIEW OF  
THE MULTIFUNCTION TIE DOWN WINCH



**FIG.45**

FIGURE 46



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